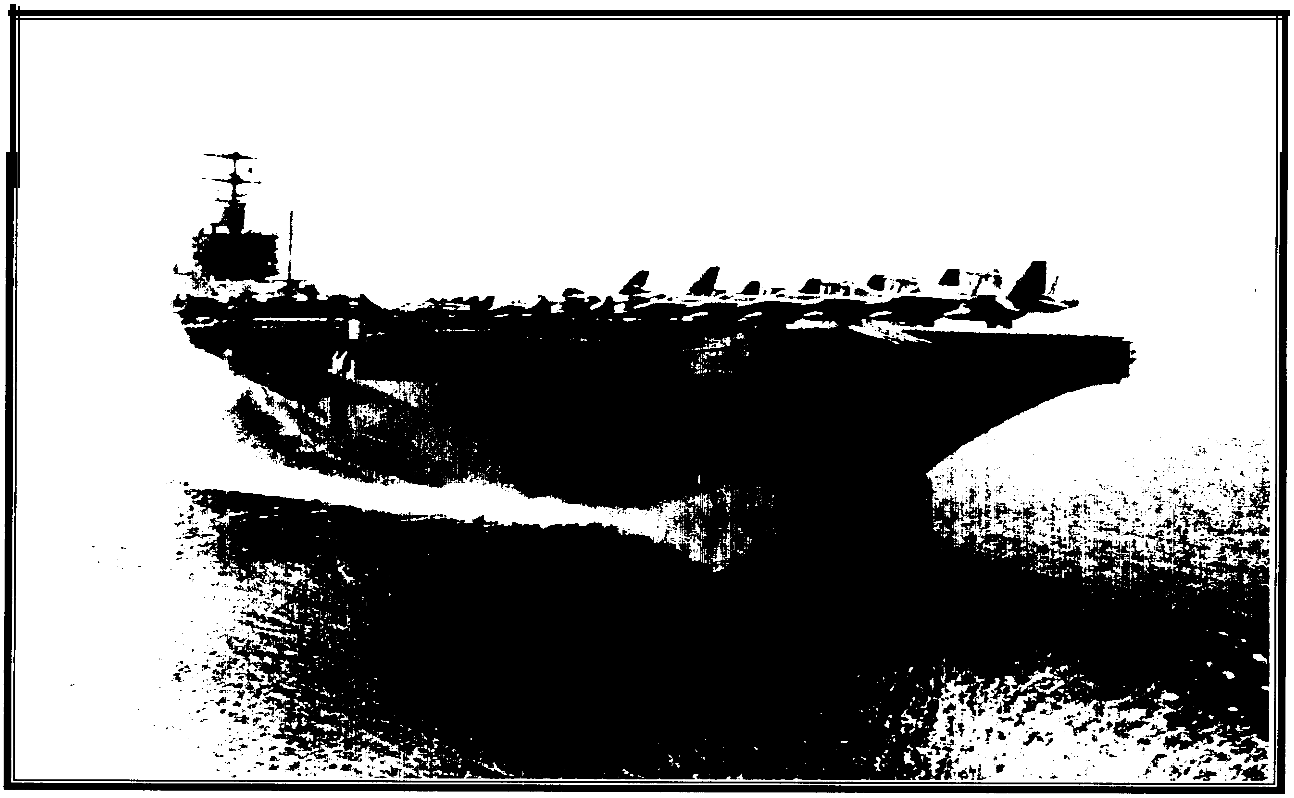
Final Environmental Impact Statement for

Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet

Coronado, California . Bremerton, Washington
Everett, Washington . Pearl Harbor, Hawaii



Volumes 2-5

Chapters 11-15, Appendices, and Supplemental Information
for Coronado, California; Bremerton, Washington; & Everett, Washington

July 1999

Department of the Navy

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VOLUME 2

Chapters 11-15, Appendices, and Supplemental Information for Coronado, California; Bremerton, Washington; & Everett, Washington

July 1999

Department of the Navy

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VOLUME 2

Chapters 11-15

July 1999

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11.0 PUBLIC INVOLVEMENT AND INTERAGENCY COORDINATION, AND DISTRIBUTION LIST

PUBLIC INVOLVEMENT AND INTERAGENCY COORDINATION

A Notice of Intent (NOI) was published in the Federal *Register* on 3 December 1996. Four scoping hearings were held, as follows: in Bremerton, Washington, on 3 February 1997; in Everett, Washington, on 4 February 1997; in Pearl City, Hawaii, on 6 February 1997; and in Coronado, California on 10 February 1997. A summary of issues identified at the scoping sessions and in letters received in responses to the NO1 are included in Appendix B.

In addition to the scoping sessions, several meetings were held. A description of these meetings is presented in section **1.6.**

The following individuals and agencies received either a Notice of Availability of the Draft EIS or a copy of the Draft EIS.

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12.0 GLOSSARY, LIST OF ABBREVIATIONS, AND ACRONYMS

12.1 GLOSSARY

activation products	The radionuclides formed as a result of a material being activated. For example, cobalt-60 is an activation product resulting from neutron activation of cobalt-59.
activation	The process of making a material radioactive by exposing the material to neutrons, protons, or other nuclear particles.
activity	A measure of the rate at which a material is emitting nuclear radiation. Activity is usually measured in terms of the number of nuclear disintegrations that occur in a quantity of the material over a period of time. The standard unit of activity is the curie (Ci), which is equal to 37 billion (3.7 x 10^{10}) disintegrations per second.
airborne emissions, radiological	Radioactivity in the form of radioactive particles, gases, or both that is transported by air.
alloy	A mixture of two or more metals.
ambient	An encompassing atmosphere.
amphipods	Small shrimp-like crustaceans (for example, sand fleas). Many live on the bottom, feed on algae and detritus, and serve as food for many marine species. Amphipods are used in laboratory bioassays to test the toxicity of sediments.
bathymetry	Information derived from measuring the depths of water in oceans, seas, and lakes.
benthic organisms	Organisms that live in or on the bottom of a body of water.
benthic	Pertaining to the bottom of the ocean.
bioaccumulation	The accumulation of chemical compounds in the tissues of an organism. For example, certain chemicals in food eaten by a fish tend to accumulate in its liver and other tissues.
biota	The flora and fauna of a region.
bioassay	A biological laboratory test used to evaluate the toxicity of a material (commonly sediments or wastewater) by measuring behavioral, physiological, or lethal responses of organisms.
cladding, fuel	A metal casing that surrounds nuclear fuel.
coastal zone	The region along the shore, adjacent to the ocean. A coastal zone is usually defined as the region within 3 nautical miles of a shoreline.

contaminant, hazardous	A chemical or biological substance in a form or in a quantity that can harm aquatic organisms, consumers of aquatic organisms, or users of the aquatic environment.
core	The central portion of a nuclear reactor containing the nuclear fuel.
corrosion	The oxidation of metal by chemical or electrochemical action.
curie	The curie (Ci) is the common unit used for expressing the magnitude of radioactive decay in a sample containing radioactive material. Specifically, the curie is that amount of radioactivity equal to 3.7 x 10^{10} (37 billion) disintegrations per second. This unit does not give any indication of the radiological consequences associated with the disintegration.
defueling	Removing of nuclear fuel from a nuclear-powered ship.
dose equivalent	A quantity used to express all radiations on a common scale for calculating the effective dose equivalent. It is defined as the product of the absorbed dose and quality factors and is expressed in rems.
dose rate	The amount of radiation dose delivered in a unit amount of time; for example, in rems per hour.
dose	The quantity of radiation or energy absorbed; usually expressed in rems for doses to man.
dosimetry	Determination of cumulative radiation dose. Also used to describe devices used to measure the amount of radiation dose.
dredge material	Sediments excavated from the bottom of a waterway or water body.
dredge spoil	Bottom sediments or materials that have been excavated from a waterway.
dredging	Any physical digging into the bottom of a water body. Dredging can be done with mechanical or hydraulic machines.
effluent	Effluent is the water flowing out of a contained disposal facility. To distinguish from runoff due to rainfall, effluent usually refers to water discharged during the disposal operation.
elutriate	The extract resulting from mixing water and dredged material in a laboratory test. The resulting elutriate can be used for chemical and biological testing to assess potential water column effects of dredged material disposal.
entrainment	The addition of water to dredged material during disposal, as it descends through the water column.
epicenter	The point on the earth's surface directly above the focus of an earthquake.
epifauna	The animals that live in association with the substrate.
exposure, external	Ionizing radiation originating outside the body.

exposure, internal	Ionizing radiation originating inside the body.
exposure, occupational	Ionizing radiation incurred during the course of employment.
exposure, radiation	The subjecting of a material or organism to ionizing radiation.
fallout	Airborne radioactive particles or dust that fall to ground.
fault	A fracture or fracture system that has experienced movement along opposite sides of the fracture.
fissile	A material whose nucleus is capable of being split (fissioned) by neutrons of all energies.
fission products	During the operation of a nuclear reactor, heat is produced by the fission (splitting) of "heavy" atoms, such as uranium, plutonium, or thorium. The residue left after the splitting of these "heavy" atoms is a series of intermediate weight atoms generally termed "fission products." Because of the nature of the fission process, many fission products are unstable and, thus, radioactive.
fission	The splitting of a heavy nucleus into two approximately equal parts that is accompanied by the release of a relatively large amount of energy and generally one or more neutrons.
fuel	Fissionable material used or reusable to produce energy in a nuclear reactor.
gamma ray	High energy, short wavelength electromagnetic radiation. Gamma rays are very penetrating and are stopped most effectively by dense materials such as lead. They are essentially similar to x-rays but are usually more energetic. Cobalt 60 is an example of a radionuclide that emits gamma rays.
groundwater	Water that is present in the pore spaces and other spaces in the rocks below the earth's surface.
half-life, radiological	The time required for half of the atoms of a radioactive material to decay to another nuclear form.
hazardous waste	Excess chemical material that is dangerous to the environment or human health.
hydraulic dredging	Dredging done by the erosive force of a water suction and slurry process, requiring a pump to move the water-suspended sediments. Pipeline and hopper dredges are hydraulic dredges.
infauna	Animals living in the sediment.
intertidal area	The area between extreme high water and extreme low water. The alternate wetting and drying of this area creates special environmental conditions. Intertidal areas tend to have organisms that are terrestrial, marine and unique to the intertidal zone.
ion	An atom or molecule which has acquired an electrical charge by gaining or losing electrons.

ionizing radiation	Any radiation that displaces electrons from atoms or molecules, thereby producing ions. Examples include alpha, beta, and gamma radiation. Exposure to ionizing radiation may produce skin or tissue damage.
irradiate	To expose to radiation.
isotope	One of two or more nuclides that have the same number of protons but have different numbers of neutrons in their nuclei. Isotopes usually have very nearly the same chemical properties but somewhat different physics.
liquefaction	In cohesionless soil, the transformation from a solid to a liquid state as a result of increased pore-pressure and reduced effective stress.
man-rem	A unit used to measure the radiation exposure to an entire group and compare the effects of different amounts of radiation on groups of people. It is obtained by multiplying the average dose equivalent (measured in rems) to the whole body by the number of persons in the population of interest.
metals	Metals are naturally occurring elements. Certain metals, such as mercury, lead, nickel, zinc, and cadmium, can be of environmental concern when they are released to the environment in unnatural amounts.
meteorological	Pertaining to the atmosphere and its phenomena, particularly weather conditions.
millirem	A unit for measuring dose equivalents that is equal to one-thousandth of a rem.
mixed waste	Waste that is radioactive and also hazardous as defined in the Resource Conservation and Recovery Act (RCRA).
monitoring, environmental	The periodic or continuous determination of the amount of radioactivity or radioactive contamination present in a region.
natural background radiation	The total amount of radiation exposure from cosmic exposure radiation and the radiation emitted by naturally occurring radioisotopes. Typically, an average annual exposure of 295 mrem to the total body occurs from background radiation.
neutron	An uncharged particle with a mass slightly greater than that of a proton, found in the nucleus of every atom heavier than hydrogen. Neutrons sustain the fission chain reaction in a nuclear reactor.
non-attainment	Air pollution non-attainment is a failure to meet one or more local, state or federal ambient air standards.
nuclear reactor	A device in which nuclear fission is initiated and controlled to produce heat which is then used to generate power.
nuclide	An atomic form of an element that is distinguished by its atomic number, atomic weight, and the energy state of its nucleus. These factors determine the other properties of the element, including its radioactivity.

overdredge material	Dredged material removed from below the dredging depth. Overdepth is incidentally removed due to dredging equipment precision. commonly overdepth dredging will average 1 foot below the needed dredging line.
particulate	Pertaining to a very small piece or part of material.
pathway	The route or course along which radionuclides could reach man.
phytoplankton	The aggregate of plants and plantlike organisms in plankton.
polychlorina ted biphenyls (PCB)	A group of man-made organic chemicals, including about 70 different, but closely related compounds made up of carbon, hydrogen, and chlorine. If released to the environment, they persist for long periods of time and can concentrate in food chains. PCBs are not water soluble and are suspected to cause cancer in humans. PCBs are an example of an organic toxicant.
pol ycyclic	A class of complex organic compounds, some of which are aromatic hydrocarbon (PAH) are persistent and/or cancer-causing. These compounds are formed from the combustion of organic material and are ubiquitous in the environment. PAHs are commonly formed by forest fires and by the combustion of organic fuels. PAHs often reach the environment through air transport of particulates, highway runoff, and oil discharge.
prototype plants	Land-based Naval nuclear reactor plants that are typical of a first design for a Naval warship and are used to test equipment and the nuclear core prior to use on a shipboard nuclear plant. The prototype plants are also used to train Naval officers and enlisted personnel as propulsion plant operators with extensive watchstanding experience and a thorough knowledge of all propulsion plant systems and their operating requirements.
quay	A structure built along the bank of a waterway for use as a landing place.
Rad	The special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram.
radiation	The emission and propagation of energy through matter or space by means of electromagnetic disturbances that display both wave-like and particle-like behavior. In this context, the “particles” are known as photons. The term has been extended to include streams of fast moving particles such as alpha and beta particles, free neutrons, and cosmic radiations. Nuclear radiation is that which is emitted from atomic nuclei in various nuclear reactions and includes alpha, beta, and gamma radiation and neutrons.
radiation level	The measured amount of radiation in a region.
radiation shielding	Materials that are used to reduce radiation levels from a radioactive source.
radiation survey	The evaluation of an area or object with instruments to detect, identify, and quantify radioactive materials and radiation fields that may be present.
radiation worker	A person qualified to work in radiation areas through training in radiation, its effects, and radiological control techniques and practices.

radioactive contamination containment	Devices as complex as a glove box or as simple as a plastic bag containments designed to limit the spread of radioactive contamination to an area as close as possible to the source and to prevent contaminating other material.
radioactive contamination	The deposition of radioactive material on any surface.
radioactive decay	The process of spontaneous transformation of a radioactive nuclide to a different nuclide or different energy state of the same nuclide. Radioactive decay involves the emission of alpha particles, beta particles, or gamma rays from the nuclei of the atoms. If a radioactive nuclide is transformed to a stable nuclide, the process results in a decrease in the number of original radioactive atoms. Radioactive decay is also referred to as radioactive disintegration.
radioactive waste	Equipment and materials that are radioactive and for which there is no other further use.
radioactivity	The process of spontaneous decay or disintegration of an unstable nucleus of an atom; usually accompanied by the emission of ionizing radiation.
radioisotope	An unstable isotope of an element that decays or disintegrates spontaneously and emits radiation.
radiological consequences	The changes to the environment or the health of a person(s) as a consequential result of the effects of radiation exposure or radioactive materials.
radionuclides	Atoms that exhibit radioactive properties. Standard practice for naming radionuclides is to use the name or atomic symbol followed by its atomic weight (e.g., cobalt-60 or Co-60).
reactor vessel	A very strong, thick-walled steel structure that contains the nuclear fuel and cooling water under high pressure during reactor operations.
rem	A unit of measure used to indicate the amount of radiation exposure a person receives (an acronym for roentgen equivalent man). The rem is specific to the biological effectiveness of radiation exposure.
riprap	Layer of large, durable fragments of broken rock, specially selected and graded. Its purpose is to prevent erosion by waves or currents and thereby preserve the shape of a surface, slope, or underlying structure.
sediment	Particles of organic or inorganic origin that accumulate in loose form.
seismicity	The quality or state of shaking or vibrating caused by an earthquake.
socioeconomic	The welfare of human beings as related to the production, distribution, and consumption of goods and services.
source term	The amounts and types of materials released into the environment as a result of either normal operations or hypothetical accident scenarios.
substrate	Substance that lies beneath and supports another.

tectonic	Pertaining to or designating the rock structures that result from the deformation of the earth's crust.
thermoluminescent dosimeter	A type of dosirneter used for personnel and environmental radiation monitoring to measure radiation doses.
topography	The detailed physical description of the surface of a region, including the relative elevations of features. The graphical representation of the physical configuration of a region on a map.
toxic	Relating to or caused by a toxin that is a poisonous substance to a living organism.
transuranic	An element with a greater atomic number than uranium.
turbidity	A measure of the amount of material suspended in the water. Increasing the turbidity of the water decreases the amount of light that penetrates the water column. Very high levels of turbidity can be harmful to aquatic life.
volatile	Readily vaporizable at relatively low temperatures.
x-rays	Penetrating electromagnetic radiations with wavelengths shorter than those of visible light. They are usually produced (as in medical diagnostic x-ray machines) by irradiating a metallic target with large numbers of high energy electrons. They are essentially similar to gamma rays but are usually less energetic and originate outside the nucleus.
zooplankton	The aggregate of animal or animal-like organisms in plankton, as protozoans.

1 ## 12.2 LIST OF ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ACRS	Advisory Commission on Reactor Safeguards
ADT	average daily traffic
AEC	Atomic Energy Commission
AICUZ	Air Installation Compatible Use Zone
ALF	Auxiliary Landing Field
ALFA-FIS	Activity Land and Facilities Assets, Version 2, Facility Information System
AMC	Army Medical Center
AMSL	above mean sea level
AOE	fast combat logistic support ship
AOR	replenishment oiler
APCD	Air Pollution Control District
APS	Air Particle Samplers
ARB	Air Resources Board
AST	above-ground storage tank
BACT	Best Available Control Technology
BEAP	Base Exterior Architecture Plan
BEHP	Bis(2-ethylhexyl)phthalate
BEQ	Bachelor Enlisted Quarters
BIA	Bureau of Indian Affairs
BMP	best management practice
BOQ	Bachelor Officers Quarters
BOW-I-S	bilge and oily waste treatment system
BPTCP	Bay Protection and Toxic Cleanup Program
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CAD	confined aquatic disposal
CalEPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CCA	California Coastal Act
CCAA	California Clean Air Act
CCD	Coastal Consistency Determination
CCR	California Code of Regulations
CDF	confined disposal facility
CDFG	California Department of Fish and Game
CEQ	Council of Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFD	computational fluid dynamics
Cfh	cubic feet per hour
C.F.R.	Code of Federal Regulations
cfu	colony forming unit
CGN	nuclear-powered guided-missile cruisers
CIA	Controlled Industrial Area
CIF	Controlled Industrial Facility
CIP	Capital Improvement Program
Cl^-	chloride
cm	centimeter
CNAP	Commander Naval Air Force, U.S. Pacific Fleet
CNEL	Community Noise Equivalent Level
CNO	Chief of Naval Operations
CO	carbon monoxide
COE	U.S. Army Corps of Engineers
COMNAVBASE	Commander Naval Base
CONUS	continental United States-
COSP	Corporate Operations Strategy Plan
CPSR	Central Puget Sound Region
CSO	combined sewer outflow
CST	Collection, Storage, and Transfer
CV	conventionally-powered aircraft carriers
CVBG	Aircraft Carrier Battle Groups
CVN	nuclear-powered aircraft carriers
CWA	Clean Water Act
cy	cubic yards
CZMA	Coastal Zone Management Act
dBA	A-weighted decibel level
DD	destroyers
DDG	guided missile destroyers
DDT	dichlorodiphenyltrichloroethane
DEIS	Draft Environmental Impact Statement
DERP	Defense Environmental Restoration Program
DM	Design Manual
DMF	depot maintenance facility

DMMO	Dredge Material Management Office
DMMP	Dredged Material Management Program
DOD	Department of Defense
DODI	Department of Defense Instruction
DOE	Department of Energy
DOH	Department of Health
DON	Department of the Navy
DOT	Department of Transportation
DPA	Development Plan Areas
DPIA	Drydock Planned Incremental Availability
DRMO	Defense Reutilization Marketing Office
DTSC	Department of Toxic Substance Control
EDG	emergency diesel generator
EFA NW	Engineering Facility Activity Northwest
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
EPA	US. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESQD	explosive safety quantity distance
FEIS	Final Environmental Impact statement
FEMA	Federal Emergency Management Agency
FFG	guided missile frigate
FISC	Fleet and Industrial Supply Center
FRERP	Federal Radiological Emergency Response Plan
FSC	Family Support Complex
FY	fiscal year
GAC	granular activated carbon
gpd	gallons per day
gpm	gallons per minute
GPS	Global Positioning System
HAP	hazardous air pollutant
HAR	Hawaii Administrative Rules
HDOH	Hawaii Department of Health
HECO	Hawaii Electric Company
HEPA	High Efficiency Particulate Air
HPAH	high molecular weight polycyclic aromatic hydrocarbons
HSWA	Hazardous and Solid Waste Amendments
HUD	Department of Housing and Urban Development
IAP	Immediate Action Program
IG	Inspector General
IMA	Intermediate Maintenance Activity
INASHIPDET	Naval Inactive Ship Maintenance Detachment
Ioc	Initial Operating Capability
IR	Installation Restoration
IRP	Installation Restoration Program
ISA	Industrial Support Area
IWTC	Industrial Wastewater Treatment Complex
IWTP	**industrial waste** treatment plant
JEG	Jacobs Engineering Group
kV	Kilovolt
kVA	kilovolt ampere
LA-5	ocean dredged material disposal site (off San Diego)
LCP	Local Coastal Plan
Ldn	day/night average sound level
LHA	Amphibious assault ship (general purpose)
LOS	level of service
LPA	low pressure air
LPH	Amphibious assault ship (dock)
LPD	Amphibious transport dock
LRA	Local Redevelopment Authority
LTMS	Long-Term Management Strategy
$\mu g/L$	microgram per liter
$\mu g/m^3$	micrograms per cubic meter
$\mu Ci/mL$	microcuries per milliliter
m	meters
m^3	cubic meters
MCAS	Marine Corps Air Station
MCBH	Marine Corps Base Hawaii
MCE	maximum credible earthquake
MFH	Military family housing
mgd	million gallons per day
mgy	million gallons per year
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MHW	mean high water
ML	maximum level
MLLW	mean lower low water
MLW	mean low water

MOA	memorandum of agreement
MPCD	marine pollution control device
MRPSA	Marine Protection, Research and' Sanctuaries Act
MSA	Military Support Area
MSCPAC	Military Sealift Command, Pacific
MSF	Maintenance Support Facility
MSL	mean sea level
MTCA	Model Toxics Control Act
MUSE	Mobile Utility Support Equipment
MVA	megavolt ampere
MWh	megawatt hour
MWR	Morale, Welfare, and Recreation
NAAQS	National Ambient Air Quality Standards
NAB	Naval Amphibious Base
NADEP	Naval Aviation Depot
NAFIS	National Association of Federally Impacted Schools
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	Naval Air Station
NASHD	Naval Air Station, San Diego Historic District
NASNI	Naval Air Station North Island
NAVCOMTELSTA	Naval Computer and Telecommunications Station
NAVFAC	Naval Facility
NAVFACENGCOM	Naval Facilities Engineering Command
NAVMAG	Naval Magazine
NAVOSH	Navy Occupational Safety and Health
NAVSEA	Naval Sea Systems Command
NAVSHIPYD	Navy Shipyard
NAVSTA	Naval Station
NAVSUBASE	Naval Submarine Base
NC	Notice of Construction
NCEL	Naval Civil Engineering Laboratory
NCIS	Naval Criminal Investigative Services
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NCRPM	National Council on Radiation Protection Measures
NEPA	National Environmental Policy Act
NFESC	Naval Facilities Engineering Service Center
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NISMF	Naval Inactive Ship Maintenance Facility
NLR	noise level reduction
NMFS	National Marine Fisheries Service
NNPP	Naval Nuclear Propulsion Program
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOD	nature of discharge
N01	Notice of Intent
NOLF	Naval Outlying Landing Field
NOX	Oxides of nitrogen (generic)
NPA	Nearest Public Access Individual
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NSR	New Source Review
NTC	Naval Training Center
ntu	nephelometric turbidity units
NVVS	Naval Weapons Station
03	Ozone
O&M	Operations & Maintenance
OPA	Oil Pollution Act
OPNAVINST	Naval Operations Instruction
ORP	Oil Recovery Plant
OSHA	Occupational Safety and Health Administration
OSHPIP	Occupational Safety and Health Program Improvement Plan
OSWER	Office of Solid Waste and Emergency Response
OTI	OSHA Training Institute
ows	Oily wastewater collection system
OWTP	oily waste treatment plant
PACNORWEST	Pacific Northwest

PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
pCi	pico Curie
PHNSY	Pearl Harbor Naval Shipyard
PHS	U.S. Public Health Service
PIA	Planned Incremental Availability
P.L.	Public Law
PM_{10}	particulate matter less than 10 microns
POL	petroleum-oil-lubrication
ppb	parts per billion
pph	pounds per hour
ppm	parts per million
ppt	parts per thousand
PPV	Public-Private Venture
P.R.C.	Public Resource Code
PSAMP	Puget Sound Ambient Monitoring Program
PSAPCA	Puget Sound Air Pollution Control Agency
PSCOG	Puget Sound Council of Governments
PSD	Prevention of Significant Deterioration
PSDDA	Puget Sound Dredged Disposal Analysis
psf	pounds per square foot
psi	pounds per square inch
psig	pounds per square inch gauge
PSNS	Puget Sound Naval Shipyard
PUC	primary urban center
PUD	Public Utility District
PWC	Navy Public Works Center
QOL	quality of life
RCRA	Resource Conservation and Recovery Act
REM	Roentgen-equivalent-man
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/ Feasibility Study
RI/RFI	Remedial Investigation/RCRA Facility Investigation
RIMS	Regional Input-Output Modeling System
ROD	Record of Decision
ROG	reactive hydrocarbons
ROI	region of influence
ROICC	Resident Officer in Charge of Construction
RONA	record of non-applicability
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
scfm	standard cubic feet per minute
SDAB	San Diego Air Basin
SDCAPCD	San Diego County Air Pollution Control District
SDG&E	San Diego Gas & Electric
SDUPD	San Diego Unified Port District
SDWA	Safe Drinking Water Act
SECNAV	Secretary of the Navy
SF	square feet
SCF	standard cubic feet
SHPO	State Historic Preservation Office
SIMA	Shore Intermediate Maintenance Activity
SIP	State Implementation Plan
SL	screening level
SMF	Ship Maintenance Facility
SMS	Sediment Management Standards
SO_2	sulfur dioxide
SOCAL	Southern California
SO-IV	Naval Facilities Engineering Command, Southwest Division
SO_x	Oxides of sulfur (generic)
SO_4	sulfates
SP	solid phase
SPAWAR	Space and Naval Warfare Systems Command Program
SPP	suspended particulate phase
SR	State Route
SRA	Subregional Area
SSF	submarine support facility
ssp.	subspecies
SUBASE	Naval Submarine Base
STU	site treatment unit
SVOC	semivolatile organic compounds
SWMU	Solid Waste Management Unit
SWPCP	Stormwater Pollution Control Plan
SWPPP	Stormwater Pollution Prevention Plan
SWWCA	ship wastewater collections ashore
TAC	toxic air contaminant
TCLP	toxicity characteristic leaching procedure
TEDE	Total Effective Dose Equivalent
TMDL	Total Maximum Daily Loads

TM	Technical Manual
TOC	total organic carbon
transpac	Transit of Pacific Ocean
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
TSP	Total suspended particulates
TSS	total suspended solids
TTO	Total Toxic Organics
UNDS	Uniform National Discharge Standards
U.S.C.	U.S. Code
U.S.C.A.	U.S. Code Annotated
USCG	U.S. Coast Guard
USD	Unified School District
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
V/C	volume to capacity ra:'3
VMT	vehicle miles traveled
VOC	volatile organic compound
WAC	Washington Administrative Code
WDOE	Washington State Department of Ecology
WDFW	Washington State Department of Fish and Wildlife
WESTPAC	Western Pacific

13.0 REFERENCES

CHAPTER 1

COE (U.S. Army Corps of Engineers). 1986. *Final Supplement to the Environmental Impact Statement. Carrier Battle Group (CVBG) Homeporting in the Puget Sound Area, Washington State.* Seattle District.

DON. 1997. Working Draft, Executive Summary, Removal and Mitigation of Underground Fuel Pipelines and Assessment of Petroleum Impacted Soil and Groundwater, Carrier Vessel Nuclear Construction Site, SWDIV Naval Air Station North Island, CA, May 2.

DON. 1996. NAVSTA Pearl Harbor Staff Civil Engineer (SCE), PHNSY SCE, FISC SCE, COMNAVBASE ACOS Housing, COMNAVBASE ACOS Facilities, PACDIV Housing Division. December.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/ Coronado to Support the Homeporting of One NIMITZ Class Aircraft* Carrier. Naval Facilities Engineering command, Southwest Division.

DON. 1995b. *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1992. *Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S. West Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command. Prepared for Commander, Naval Sea Systems Command.

CHAPTER 2

DON. 1997a. *Homeport Analysis for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet.* Commander, Naval Air Force, U.S. Pacific Fleet.

DON 1997b. *Carrier Airwing Basing in Hawaii, Part of a Potential Alternative to Homeport a NIMITZ-Class Aircraft Carrier in Pearl Harbor.* Commander, Naval Air Force, U.S. Pacific Fleet.

DON 1997c. *Draft Major CVN Homeporting Criteria.* David Curfman, Specialist Assistant for Wharfs and Waterfronts, Naval Facilities Engineering Command.

DON 1997d. *Interim Technical Guidance (ITG) - CVN Dredge Depth Criteria.* David Curfman, Specialist Assistant for Wharfs and Waterfronts, Naval Facilities Engineering Command.

DON. 1996. Hydrographic Survey Maps, Pearl Harbor, 19954996. Naval Station Pearl Harbor.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/ Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering command, Southwest Division.

DON. 1995b. *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1995c. Letter, Commander, Naval Sea Systems (03D3/242) (3 Jan 95).

DON. 1992. *Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S. West Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command. Prepared for Commander, Naval Sea Systems Command.

DON. 1991. *Master Plan 1991. Naval Air Station North Island.* Contract N68711-89-C-00382.

TOPOGRAPHY, GEOLOGY, AND SOILS

Atwater, B.F. 1987. Evidence for Great Holocene Earthquakes along the Outer Coast of Washington State. Science 236(4804): 942-944.

Atwater, B.F. and A. Moore. 1992. A Tsunami about 1000 Years Ago in Puget Sound, Washington. Science 258: 1611-1623, December 4.

Bucknam, R.C., E. Hemphill-Haley, and E.B. Leopold. 1992. Abrupt Uplift within the Past 1,700 Years at Southern Puget Sound, Washington. *Science* 258: 1611-1624, December 4.

City of Coronado 1974. *City of Coronado Master Plan.*

COE. 1986. *Final Supplement Environmental Impact Statement. Carrier Battle Group (CVBG) Homeporting in the Puget Sound Area, Washington State.* **Seattle District.**

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* **Naval Facilities Engineering Command, Southwest Division.**

DON. 1995b. *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1994. *Draft Naval Station Everett Family Support Complex Master Plan.* **US Navy, Western Division, Naval Facilities Engineering Command. 5**

DON. 1992a. *Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S. West Coast Homeporting Program.* **Chesapeake Division, Naval Facilities Engineering Command.** Prepared for Co**mmander, Naval Sea Systems Command.**

DON. **1992b. Naval Engineering Facilities Command (NAVFAC). Manual P-355-Seismic Design For Buildings.**

DON. 1992c. **Naval Engineering Facilities Comman**d (NAVFAC). Manual DM 26 Series. Harbor and Coastal Facilities Design Manual.

DON. 1992d. Naval Engineering Facilities Command (NAVFAC). Manual DM 7.01, 7.02, 7.03.

DON. 1991. *Master Plan 1991. Naval Air Station North Island.* Contract N68711-89-C-0038.

DON. 1989. *Master Plan — Bremerton Naval Complex.* Western Division, Naval Facilities Engineering Command.

Ferrito, J. 1993. Seismic Hazard Analysis, Naval Civil Engineering Laboratory (NCEL) User's Guide, UG-0027.

Ferver Engineering Company. 1994. Aircraft Carrier Wharf, Basis of Design, 15 Percent Design, (Preliminary Submittal).

HartCrowser 1990. Geotechnical Engineering Design Report, NAVSTA Puget Sound, Everett, Washington, prepared for the Department of the Navy, Naval Facilities Engineering Command, Western Division and CNA Architecture Group.

Inman, D.L., and C.E. Nordstrom. 1973. Beach Cliff Erosion in San Diego County, California. In: *Studies on the Geology and Geologic Hazards of the Greater San Diego Area, California.* Ross, A. and Dowlen, R.J., eds., San Diego Association of Geologists, pp. 125-131.

Johnson, S.Y., C.J. Potter, and J.M. Armentrout. 1994. Origin in Evolution of the Seattle Fault and Seattle Basin, Washington. *Geology 22:* **71-74.**

Karlin, R.E., and S.E.B. Abella. 1992. Paleoearthquakes in the Puget Sound Region Recorded in Sediments from Lake Washington, U.S.A. *Science* 258: 1611-1623, December 4.

Oahu Civil Defense. 1997. Descriptions of Tsunami Evacuation Zones.

Pacific Geotechnical Engineers, Inc. 1993. Preliminary Consultation Letter Geotechnical Engineering Services FY94 MCON Project P-468 Environmental Laboratory Renovations for Industrial Waste Treatment Complex Pearl Harbor, Oahu, Hawaii.

Ploessel, M.R., and J.E. Slosson. 1974. Repeatable High Ground Accelerations from Earthquakes. *California* Geology September.

Schuster, RL., R.L. Logan, and P.T. Pringle. 1992. Prehistoric Rock Avalanches in the Olympic Mountains, Washington. *Science* 258: 1611-1623, December 4.

Sea Engineering, Inc. 1989. Ford Island Scoping Report, Oceanographic Parameters. Honolulu, HI.

Treiman, J.A. 1984. The Rose Canyon Fault Zone, A Review and Analysis: Unpublished Report for Federal Emergency Management Agency, Cooperative Agreement EMF-83-K-0148; California Department of Conservation, Division of Mines and Geology.

UH (University of Hawaii at Manoa). 1995. Ask-an-Earth-Scientist web page. Department of Geology and Geophysics. 20 December.

USDA (U.S. Department of Agriculture), Soil Conservation Service. 1972. Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.

USGS (U.S. Geological *Survey). 1996. Assessing Earthquake Hazards and Reducing Risk in the Pacific Northwest.* United States Geological Survey, Professional Paper 1560.

Walsh, T.J. and Logan, R.L. 1997. *Washington Geology,* vol. 25, no. 4, December.

WDGER (Washington Division of Geology and Earth Resources). 1988. *Washington State Earthquake Hazards*. Washington Division of Geology and Earth Resources, Information Circular 85.

Woodward-Clyde Consultants. 1998. Additional Fault Hazard Investigation, CVN Berthing Wharf-Phase II (P-700A), Naval Air Station North Island, Coronado, California. Prepared for Naval Facilities Engineering Command, South Bay Area Focus Team, August.

Woodward-Clyde Consultants. 1994a. Geotechnical Investigation, Proposed Dredging along Quaywall and Turning Basin (P-549), Naval Air Station, North Island, Coronado, California (Draft report). Prepared for U.S. Department of the Navy Naval Facilities Engineering Command Southwest Division.

Woodward-Clyde Consultants. 1994b. Geotechnical Investigation, Proposed Aircraft Carrier Wharf (P-700), Naval Air Station, North Island, Coronado, California (Draft report). Prepared for U.S. Department of the Navy Naval Facilities Engineering Command Southwest Division.

Woodward-Clyde Consultants. 1994c. Seismic Hazards Assessment Proposed NIMITZ Class Aircraft Carrier Homeporting Project, Naval Air Station, North Island, Coronado, California (Draft report). Prepared for U.S. Department of the Navy Naval Facilities Engineering Command Southwest Division.

Youd, T.L. 1993. Liquefaction-Induced Lateral Spread Displacement, Naval Civil Engineering Laboratory (NCEL) Technical Note N-1862.

HYDROLOGY

CEQ. 1993. *Pollution prevention and the National Environmental Policy Act*. January 12.

DON. 1997. Draft RI/RFI Report-Site 1 Shoreline Sediments, NAS North Island, January.

DON. 1996a. *Environmental Restoration Plan for Fiscal Years 1997-2001, North Island Naval Air Station, San Diego, California.*

DON. 1996b. *Environmental Restoration Plan for Fiscal Years 1997-2001, Naval Station Everett.*

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. 1995b. *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1994a. *Draft Naval Station Everett Family Support Complex Master Plan. U.S Navy, Western Division, Naval Facilities Engineering Command.* May.

DON. 1994b. *PEP II — Parking Structure at Puget Sound Naval Shipyard, Bremerton (BRAC Project P-300T).* Bremerton, Washington.

DON. 1994c. PEP *III — Playing Fields at Puget Sound Naval Shipyard, Bremerton (BRAC Project P-305T).* Bremerton, Washington. DON. 1993. Final Screening Site Inspection Report for the Comprehensive Long-term Environmental Action Navy (CLEAN) Program Northwest Area, April.

DON. *1992. Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S. West Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command. Prepared for Commander, Naval Sea Systems Command.

DON. 1989. Master Plan — Bremerton Naval Complex. Western Division, Naval Facilities Engineering Command.

Earth Tech, Inc. 1997. Draft Site Summary Report of the Pearl Harbor Naval Complex, Pearl Harbor, Hawaii. Prepared for DON, Pacific Division, Naval Facilities Engineering Command.

JEG (Jacobs Engineering Group). 1997. Final Work Plan Addendum for RI Sampling, Site 9, NAS North Island, San Diego, California.

Mink, John F., and L. Stephen Lau. 1990. Aquifer Identification and Classification for O'ahu: Groundwater Protection Strategy for Hawai'i. Water Resources Research Center, University of Hawaii, Honolulu.

URS Consultants, Inc. 1995. Final Remedial Investigation Operable Unit NSC, Fleet and Industrial Supply Center, Bremerton, Washington, prepared for Engineering Field Activity, Northwest, Southwest Division, Naval Facilities Engineering Command, Poulsbo, Washington, September.

MARINE WATER QUALITY

Alvarez, Lehman & Associates, *Inc.* 1985. *Final Report on Environmental Monitoring Naval Submarine Base, Kings Bay, Georgia.* October 2983 *to September* 1984. Presented to the Department of the Navy.

Boatman, C.D. and D.A. Hotchkiss. 1997. Tidally Influenced Containment Berm Functioning as a Leachate Treatment Cell — Puget Sound Experience in Confined Disposal of Contaminated Sediments. Proceedings, International Conference on Contaminated Sediments, , Rotterdam, The Netherlands. (Ted)

Bremerton/Kitsap County Health District. 1992. Sinclair Inlet Watershed Long-Term Water Quality Assessment Phase 1: Status Report No. 2.

Burks, S.L., and RM. Engler. *1978. Water Quality Impacts of Dredged Material Disposal: Laboratory Investigations.* Technical Report DS-78-04, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

CAS (Columbia Analytical Systems). 1994. Dredged Material Sediment Testing Results for Project Ml-90 Maintenance Dredging at Pier Bravo, Naval Air Station, North Island, San Diego, CA. Vol. 1. Technical Report. Report prepared for U.S. Navy, Southwest Division, Engineering Command.

COE. 1976. Dredge Disposal Study, San Francisco Bay and Estuary, *Appendix C, Water Column.*

COE. *1988. Final Environmental Impact Statement — Unconfined Open Water Disposal Sites for Dredged Material, Phase I (Central Puget Sound).* Puget Sound Dredged Disposal Analysis Program. Seattle, Washington.

COE, Seattle District, Washington Department of Ecology, and Port of Seattle. 1994. Draft Environmental Impact Statement, Southwest Harbor Cleanup and Redevelopment Project. Technical Appendix A-3, Modeling Report. Prepared by Converse Consultants Northwest and Pacific Groundwater Group. (Ted)

Converse Consultants Northwest. 1992. Terminal 91 Short Fill Monitoring Program. Final Project Report. Prepared for the Port of Seattle in conjunction with Pacific Groundwater and Hall and Associates. (Ted)

Dames & Moore. 1994. Baseline Year Water and Sediment Quality Certification Monitoring Report. Volume 1. Prepared for Naval Station Everett.

DON. 1998. Development of Facilities to Support Deep-Draft, Power-Intensive (DDPI) Ships, Naval Station San Diego. Preliminary Draft Alternatives Analysis.

DON. 1996a. Supplement to Pre-Dredge Monitoring Report, CVN Homeporting Project, Naval Air Station, North Island, Coronado, California. Submitted to Regional Water Quality Control Board, San Diego Region.

DON. 1996b. Draft Remedial Investigation Report Operable Unit B, Puget Sound Naval Shipyard, Bremerton, Washington. U.S. Navy CLEAN CTO No. 0131. Prepared by URS Consultants, Inc. Seattle, Washington. September 16.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. 1995b. *Sediment Characterization Report for NIMITZ Class Aircraft Carrier Homeporting Facilities, Naval Air Station, North Island, California.* Volume 1 — Sediment Analysis Results.

DON. 1994. *Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities.* Washington, D.C.: Report NT-941, Naval Nuclear Propulsion Program (NNPP).

DON. 1992a. *Draft Programmatic EIS for Dredged Material Disposal.* Southwest Division Naval Facilities Engineering Command. San Diego, CA.

DON. 1992b. Site Inspection Study, Puget Sound Naval Shipyard Site Inspection Report, Bremerton, Washington. Prepared by URS Consultants, Inc. under U.S. Navy CLEAN Contract N6247489-D-9295. Seattle, Washington.

DON. 1992c. *Final Programmatic Environmental Impact Statement; Fast Combat Support Ship (AOE-6 Class). U.S. West Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command.

DON. 1991. *Draft Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S. West Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command. Prepared for Commander, Naval Sea Systems Command.

DON. 1990. Final Environmental Impact Assessment for Proposed Developments at Naval Base Pearl Harbor, Oahu, Hawaii. Prepared by Belt Collins & Associates for PACNAVFACENGCOM.

DON. 1985. *Final Environmental Impact Statement: Carrier Battle Group (CVBG) Homeporting in the Puget Sound Area, Washington State.*

DON. 1975. Determination of a Zone of Mixing for the Fort Kamehameha Sewage Treatment Plant Discharge. Environmental Branch, Pacific Division, Naval Facilities Engineering Command.

Downing, J.P., C.E. Sweeny, T.C. Demlow, and W.D. Eysink. 1987. Predictions of Shoaling Rates for a New Harbor in Puget Sound, Washington. In Magoon, O.T., H. Converse, D. Miner, L.T. Tobin, D. Clark, and G. Domurat (eds.). Coastal Zone 1987: Volume I: Proceedings of the Fifth Symposium on Coastal and Ocean Management. American Society of Civil Engineers.

Environvision. 1991. Sinclair Inlet Water Quality Assessment. Prepared for Sinclair Inlet Watershed Management Committee, Kitsap County Department of Community Development.

EPA. 1987. *Radiological Survey of the Pearl Harbor Naval Shipyard and Environs, Honolulu, Hawaii,* 520/5-87-010.

EPA. 1988. Final Environmental Impact Statement for Designation of LA-5 Ocean Dredged Material Disposal Site.

EPA. 1989a. Radiological Survey of San Diego Bay. 520/5-88-019.

EPA. 1989b. Radiological Survey of Naval Facilities on Puget Sound. 520/5-88-016.

EVS Environment Consultants, *Inc.* 1997. *Release of Contaminantsfiom Suspended Particulate Matter. Port of Oakland D-foot Channel Deepening Project.* Prepared for the Port of Oakland, California. EVS Project No. 2/749-01.12. Seattle, Washington.

Flegal, A.R, and S.A. Sañudo-Wilhelmy. 1993. Comparable Levels of Trace Metal Contamination *in* Two Semi-Enclosed Embayments: *San Diego* Bay and *South San* Francisco Bay. *Environ. Sci. Technol.* 27:1934-1936.

Francinques, N.R, M.R. Palermo, CR. Lee, and RK. Peddicord. 1985. *Management Strategy for Disposal of Dredged Material: Test Protocols and Contaminant Control Measures. Miscellaneous* Paper D-85-1. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

George, R., and J.L. Largier. 1995. Lagrangian Drifter Observations in San Diego Bay: Data Report, Scripps Institution of Oceanography, Reference Report.

Grovhoug, J. 1992. Evaluation of Sediment Contamination in Pearl Harbor, Technical Report 1502. Naval Command, Control, and Ocean Surveillance Center, RDT&E Division, San Diego, CA.

Hammond, R.R., and W.J. Wallace. 1982. Seabed Drifter Movement in San Diego Bay and Adjacent Waters. *Estuar. Coast. Shelf Sci.* 14:623-634.

Havis, RN. 1988. A Preliminary Evaluation of Contaminant Release at the Point of Dredging. Environmental Effects of Dredging Technical Notes, EEDP-09-l. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Hawaii Department of Health. 1992. Hawaii Administrative Rules (HRA), Title 11, Chapter 54, Water Quality Standards.

Hotchkiss, D.A. and C.D. Boatman. 1994. Nearshore Confined Disposal in a Tidally Influenced Environment — Design and Operation Experience in Puget Sound. DREDGING '94. Proceedings of the Second International Conference, sponsored by the Waterways Committee of the Waterway, Port, Coastal and Ocean Division/AXE. Lake Buena Vista, Florida. (Ted)

Largier, J.L. 1995. *San Diego Bay Circulation.* Final Report prepared for the California State Water Resources Control Board and California Regional Water Quality Control Board, San Diego Region.

LaSalle, M. 1984. Physical and Chemical Alterations Associated with Dredging: An Overview, in: *Effects of Dredging on Anadromous Pacific Coast Fishes.* C.A. Simenstad, Ed. Seattle: University of Washington Press.

Lunz, J.D. 1987. Environmental Considerations during Dredging Operations. *In Sedimentation Control to Reduced Maintenance Dredging of Navigational Facilities in Estuaries.* Report and Symposium Proceedings. Marine Board, Commission on Engineering and Technical Systems, National Research Council. National Academy Press, Washington, D.C.

MEC Analytical Systems, Inc. 1992. Results of Chemical, Physical, and Bioassay Analyses on Sediments from Bravo Pier and the Aircraft Carrier Turning Basin in the San Diego Bay, California. Report prepared for U.S. Navy, Southwest Division, Engineering Command.

NNPP (U.S. Department of the Navy, Naval Nuclear Propulsion Program). 1997. Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities, Report NT-97-l.

NORTEC (Northern Technical Services, Inc.). 1985. Results of Offshore Siting Surveys for a Deepwater Dredge Spoil Disposal Site, Port Gardner, Washington.

O'Connor, T.P., and B. Beliaeff. 1995. *Recent Trends in Coastal Environmental Quality: Results from the Mussel Watch Project.* U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service. Silver Spring, MD.

Parametrix. 1998. St. Paul Waterway Area Remedial Action and Habitat Restoration Project, 1997 Monitoring Report. Prepared for Simpson Tacoma Kraft Company, Tacoma, Washington, and Champion International, Stamford, Connecticut. (Ted)

PRC Environmental Management. 1996. Report of Copper Loading to San Diego Bay, California. Report prepared for California Water Quality Control Board and San Diego Bay Interagency Panel.

SDUPD (San Diego Unified Port District). 1980. *Final Environmental Impact Report on the Master Plan.* Environmental Management Department.

Sea Engineering, Inc. 1989. Ford Island Scoping Report, Oceanographic Parameters. Honolulu, HI.

Stem, E.M., and W.B. Stickle. 1978. *Effects of Turbidity and Suspended Material in Aquatic Environments: Literature Review.* Technical Report D-78-21. Prepared by the University of Wisconsin and Louisiana State University. Prepared for the U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Tetra Tech. 1988. Sinclair and Dyes Inlets Action Program: Initial Data Summari'es and Problem Identification. Prepared for U.S. Environmental Protection Agency, Region 10, Office of Puget Sound, Seattle, Washington.

URS Consultants. 1989. *East Waterway Cleanup Reconnaissance Study — Associated Issues Report.* Prepared for Washington State Department of Ecology, Olympia, Washington.

Valkirs, A.O., B.M. Davidson, L.L. Kear, RL. Fransham. 1994. Environmental Effects from In-Water Hull Cleaning of Ablative Copper Antifouling Coatings. Technical Document 2462.

Wakeman, T.H. 1977. Release of Trace Constituents from Sediments Resuspended during Dredging Operations. T.F. Yen, Ed., Chemistry *of Marine Sediments. Michigan: AM* Arbor Science.

WDOE (Washington State Department of Ecology). 1992. WAC 173-201 A.

SEDIMENT QUALITY

Beak Consultants. 1995. *Puget Sound Naval Shipyard Pier D Long-Tenn Monitoring, Final Report, 1995 Sampling and Analysis.* Prepared for RCI Environmental Incorporated and Department of the Navy, Resident Officer in Change of Construction, Bremerton, Engineering Field Activity Northwest, Naval Facilities Engineering Command, Bremerton, Washington. Kirkland, Washington.

CAS (Columbia Analytical Systems). 1994. Dredged Material Sediment Testing Results for Project Ml-90 Maintenance Dredging at Pier Bravo, Naval Air Station, North Island, San Diego, CA. Vol. 1. Technical Report. Report prepared for U.S. Navy, Southwest Division, Engineering Command.

COE. 1988. *Final Environmental Impact Statement — Unconfined Open Water Disposal Sites for Dredged Material, Phase I (Central Puget Sound).* Puget Sound Dredged Disposal Analysis Program. Seattle, Washington.

COE and EPA. 1997. *Regional Implementation Manual.* Requirements and Procedures for Evaluation of Dredged Material Proposed for Ocean Disposal in the State of Hawaii. Draft, January.

Dames & Moore. 1994. *Baseline Year Water and Sediment Quality Certification Monitoring Report.* Volume 1. Prepared for Naval Station Everett.

DON. 1998a. Development of Facilities to Support Deep-Draft, Power-Intensive (DDPI) Ships, Naval Station San Diego. Preliminary Draft Alternatives Analysis.

DON. 1998b. *Combined Sampling and Analysis Plan (CSAP), Feasibility Study and Sediment Characterization at Puget Sound Naval Shipyard, Bremerton, Washington.* Prepared with the assistance of Science Applications International Corporation, Bothell, Washington. Submitted by Engineering Field Activity, Northwest, Poulsbo, Washington. November 13.

DON. 1997. Draft RI/RFI Report-Site 1 Shoreline Sediments, NAS North Island, January.

DON. 1996a. Work Plan for Unexploded Ordnance (UXO) Location and Removal, NAS North Island, San Diego, CA. Prepared by Wyle Laboratories for Navy SOUTHWEST NAVFACENGCOM, San Diego.

DON. 1996b. *Draft Remedial Investigation Report, Operable Unit B, Puget Sound Naval Shipyard, Bremerton, Washington.* U.S. Navy CLEAN CTO 131. Prepared by URS Consultants, Inc., Seattle, Washington.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. 1995b. Sediment Characterization Report for NIMITZ Class Aircraft Carrier Homeporting Facilities, Naval Air Station, North Island, California. Volume 1 — Sediment Analysis Results. NASNI.

DON. 1990. Final Environmental Impact Assessment for Proposed Developments at Naval Base Pearl Harbor, Oahu, Hawaii. Prepared by Belt Collins & Associates for PACNAVFACENGCOM.

DON. 1983. Initial Assessment Study of Pearl Harbor Naval Base, Oahu, Hawaii. Naval Energy and Environmental Support Activity, Port Hueneme, California.

EPA. 1987. *Radiological Survey of the Pearl Harbor Naval Shipyard and Environs, Honolulu, Hawaii,* 520/5-87-010.

EPA. 1988. Final Environmental Impact Statement for Designation of LA-5 Ocean Dredged Material Disposal Site.

EPA. 1989a. Radiological Survey of San Diego Bay. 520/5-88-019.

EPA. 1989b. Radiological Survey of Naval Facilities on Puget Sound. 520/5-88-016.

EPA and COE. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal- Testing Manual. Office of Water. Washington, DC. EPA-503/8-91 /001.

Fairey, R, C. Bretz, S. Lamerdin, J. Hunt, B. Anderson, S. Tudor, C.J. Wilson, F. LaCaro, M. Stephenson, M. Puckett, and E.R. Long. 1996. *Chemistry, Toxicity and Benthic Community Conditions in Sediments* of *the San Diego Bay Region.* Final Report. California Water Resources Control Board. Sacramento.

GeoEngineers. 1991. *Environmental Services Dredging Project, Pier D Sediment Characterization, Bremerton Naval Shipyard.* Prepared for the U.S. Navy, Engineering Field Activity Northwest, Poulsbo, Washington.

Grovhoug, J. 1992. Evaluation of Sediment Contamination in Pearl Harbor, Technical Report 1502. Naval Command, Control, and Ocean Surveillance Center, RDT&E Division, San Diego, CA.

Llansó, RJ., S. Aesen, and *K.* **Welch.** *1998. Marine Sediment* ***Monitoring Program. Volumes I and II.*** *Chemistry and Toxicity Testing 19894995 (Volume I) and* ***Distribution and Structure of Benthic*** *Communities in Puget Sound 19894993 (Volume II).* Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program. Waterbody Number WA-01-0010. **Publication No. 98-323 and 98-328.**

McLaren, P. 1998. *Sediment Trend Analysis of Sinclair Inlet/Port Orchard.* **Prepared for URS Greiner,** Seattle, Washington, by **GeoSea Consulting (Canada), Ltd., Brentwood Bay, British Columbia.**

MEC Analytical Systems, Inc. 1992. Results of Chemical, Physical, and Bioassay Analyses on Sediments from Bravo Pier and the Aircraft Carrier Turning Basin in the San Diego Bay, California. Report prepared for U.S. Navy, Southwest Division, Engineering Command.

NNPP. 1997. Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities, Report NT-97-l.

SAIC. 1998. Combined Sampling and Analysis Plan (CSAP), Feasibility Study and Sediment Characterization at Puget Sound Naval Shipyard, Bremerton, Washington. Prepared for the U.S. Navy, Naval Facilities Engineering Cornrnand, **Engineering Field Activity** Northwest, Poulsbo, Washington. Approved by the Puget Sound Dredged Material Management Program (DMMP). November.

Woodward-Clyde. 1998. Summary of Sediment Sample Analytical Results, CVN Berthing Wharf — Phase II (P-700A). Letter report to Naval Facilities Engineering Command, U.S. Navy, San Diego, California.

MARINE BIOLOGY

Ainley, D.G., and S.G. Allen. 1992. Abundance and Distribution of Seabirds and Marine Mammals in the Gulf of the Farallones: Final Report to the Environmental Protection Agency (Region IX), LTMS Study Group by the Point Reyes Bird Observatory.

Allen, L.G. 1998. Fisheries Inventory and Utilization of San Diego Bay, San Diego, California. 4rd Annual Report, FY 1997-1998. Summary of sampling period July 1994 to April 1998. Prepared for the U.S. Navy, Naval Facilities Engineering Command Southwest Division and San Diego Unified Port District. 25pp + figures, tables, and appendices.

Allen, L.G. 1997. Fisheries Inventory and Utilization of San Diego Bay, San Diego, California. 3rd Annual Report, FY 1996-1997. Summary of sampling period July 1995 to April 1997. Prepared for the U.S. Navy, Naval Facilities Engineering Command Southwest Division and San Diego Unified Port District.

Allen, L.G. 1996. Fisheries Inventory & Utilization of San Diego Bay, San Diego, California. Second Annual Report, FY 1995-1996, Summary for the Sampling Period July 1994 to April 1996. Nearshore Marine Fish Research Program. Department of Biology, California State University, Northridge.

Allen, L.G. 1988. Recruitment, Distribution, and Feeding Habits of Young-of-the-Year California Halibut (*Paralichthys californicus*) in the Vicinity of Alamitos Bay-Long Beach Harbor, California, 1983-1985. Bull. So. *Calif. Acad. Sci.* 87(1):19-30.

Antrim, L. 1996. *Report for Eelgrass, Macroalgae, and Macrobenthos Surveys at Foot Ferry Passenger Terminals.* Preliminary survey summary report included in letter to the Washington State Department of Transportation, Environmental Affairs.

Auld and Schubel. 1978. Effects of Suspended Sediments on Fish Eggs and Larvae, A Laboratory Assessment. *East. Coast. Mar. Sci.* 6:153-164.

B.P. Bishop Museum. 1997. Biodiversity of Marine Communities in Pearl Harbor, Oahu, Hawaii with observations on introduced exotic species. Contribution No. 1997-014, Hawaiian Biological Survey. Honolulu: Bishop Museum Press. vii + 76 p + appendices.

COE. 1992. *Richmond Harbor Deepening Project — Final Environmental Working Paper.* Prepared by Science Applications International Corporation for the U.S. Army Corps of Engineers, San Francisco District.

COE. 1988. *Final Environmental Impact Statement — Unconfined Open Water Disposal Sites* for *Dredged* Material, *Phase I (Central Puget Sound).* Puget Sound Dredged Disposal Analysis Program. Seattle, Washington.

Dames & Moore. 1994. Baseline Year Water and Sediment Quality Certification Monitoring Report. Volume 1. Prepared for Naval Station Everett.

DON. 1999. Sinclair Inlet Aquascape Plan - Sinclair Inlet Existing Conditions Data Compilation. Operable Unit B. Puget Sound Naval Shipyard, Bremerton, Washington, CTO 0131. Prepared for the Engineering Field Activity Northwest, Naval Facilities Engineering Command by the URS Consultants with assistance from Science Applications International Corporation.

DON. 1996. Draft Remedial Investigation Report Operable Unit B, Puget Sound Naval Shipyard, Bremerton, Washington. U.S. Navy CLEAN CTO No. 0131. Prepared by URS Consultants, Inc. Seattle, Washington.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. 1995b. *Environmental* Assessment *for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1995c. Environmental Assessment for Modifications to the Design of the Ford Island Bridge, NAVSTA Pearl Harbor. Prepared by Belt Collins Hawaii.

DON. 1994a. *Waterbird Survey, North and Central San Diego Bay,* 1993. Prepared for Naval Air Station North Island, by Southwest Division, Naval Facilities Engineering Command, U.S. Department of the Navy.

DON. 1994b. San Diego Bay Eelgrass Final Survey Charts. Prepared by U.S. Department of the Navy, Southwest Division, SOUTHWESTNAVFACENGCOM, San Diego, CA.

DON. 1994c. *Pre-Final Environmental Assessment. Project Development along the East Waterway, Naval Station Everett, Washington.* Prepared by EDAW, Inc.

DON. 1993a. *Hydrogeological and Biological Investigation. Puget Sound Naval Shipyard, Bremerton, Washington, CTO 0036. Biological Report.* Comprehensive Long-Term Environmental Action. Prepared for the Engineering Field Activity Northwest, Naval Facilities Engineering Command by the URS Consultants with assistance from Science Applications International Corporation, B&V Waste Science and Technology Corporation, and Shannon & Wilson, Inc.

DON. 1993b. *Draft Supplemental Environmental Impact Statement — Appendices. Element II Breakwater/Pier, Naval Station Everett, Washington.* Prepared by Parametrix, Inc., Kirkland, WA.

DON. 1992a. *Draft Programmatic EIS for Dredged Material Disposal* (from Volume I of 3 volumes). Prepared by the U.S. Department of the Navy, Southwest Division, Naval Facilities Engineering Command, U.S. Department of the Navy.

DON. 1992b. *Supplemental Revised Environmental Impact Statement, 100% Draft Submittal. Element II Carrier Battle Group Homeporting in the Puget Sound Area, Washington State.* Prepared by Parametrix, Inc., Kirkland, WA.

DON. 1992c. *Final Programmatic Environmental Impact Statement; Fast Combat Support Ship (AOE-6 Class). U.S. West Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command.

DON. 1985. *Final Environmental Impact Statement. Carrier Battle Group (CVBG) Homeporting in the Puget Sound Area, Washington State.*

DON. 1984. *Draft Environmental Impact Statement. Carrier Battle Group (CVBG) Homeporting in the Puget Sound Area, Washington State.*

Environmental Assessment Co. 1997. Benthic Macrofaunal Invertebrates of Pearl Harbor — April. Prepared for Marine Research Consultants.

EPA. 1993. *Final Environmental Impact Statement (EIS) for Designation of a Deep Water Ocean Dredge Material Disposal Site Off San Francisco, California.* U.S. Environmental Protection Agency, Region IX, San Francisco, CA.

EPA. 1989a. Radiological Survey of San Diego Bay. 520/5-88-019.

EPA. 1989b. *Radiological Survey of Naval Facilities on Puget Sound.* 520/5-88-016

EPA. 1987. *Radiological Survey of the Pearl Harbor Naval Shipyard and Environs, Honolulu, Hawaii,* 520/5-87-010.

EPA and COE. 1991. *Evaluation of Dredged Material for Ocean Disposal — Testing Manual [Green Book]).*

Fancher, J. 1993. *Studies of the Birds of South San Diego Bay: A Fiscal 2993 Progress Report of the San Diego Bay/Southern California Bay and Estuary Program.* U.S. Fish and Wildlife Service, Carlsbad, CA.

Ford, R. F. 1986. Distributional Limits of the Eelgrass Bed along the Southeastern Shores of Coronado Cays, San Diego Bay, in February 1986. Prepared for David D. Smith & Associates, Inc., San Diego, California, and Coronado Landmark, Inc., Irvine, California.

Ford, R.F. 1968. Marine Organisms of South San Diego Bay and the Ecological Side Effects of Power Station Cooling Water. A pilot study conducted for San Diego Gas & Electric Co., California. Environmental Engineering Laboratory Technical Report on Contract C-188.

Ford, R. F., and R. L. Chambers. 1974. Final Report. Biological Studies at the South Bay Power Plant during the Period September 197%July 1973. San Diego Gas & Electric Company Purchase Order P-25072.

Germano, J. D., and D. C. Rhoads. 1984. REMOTS Sediment Profiling at the Field Verification Program (FVP) Disposal Site. *Dredging and Dredged Material Disposal.* Vol. 1, New York: Am. Soc. Civil Engineers. pp. 536544.

Grovhoug, J. 1992. Evaluation of Sediment Contamination in Pearl Harbor, Technical Report 1502. Naval Command, Control, and Ocean Surveillance Center, RDT&E Division, San Diego, CA.

Hanan, D., and J. Sisson. 1992. Marine Mammal Resources. Pages 208-211, In: *California's Living Marine Resources and Their Utilization.* W.S. Leet, C.M. Dewees, and C.W. Haugen, editors. California Sea Grant Publication UCSGEP-92-12.

Hawaii Department of Health. 1992. Hawaii Administrative Rules (HRA), Title 11, Chapter 54, Water Quality Standards.

Hoffman. 1986. Fishery Utilization of Eelgrass (*Zastera* marina) Beds and Non-Vegetated Shallow Water Areas in San Diego Bay. NOAA, Southwest Region, Admin. Rep. SWR-86-4.

Hueckel, G. 1987. *Bremerton Fishing Pier Underwater* Survey. Letter Report. Washington Department of Fisheries Marine Fish Habitat Investigations Survey.

Johnston and Wildish. 1981. Avoidance of Dredge Spoil by Herring (*Clupea hareusus hareugus*). *Bulletin Environ. Contamin. Tox. 76:* 307-314.

Lagomarsino, I. 1992. Whales, Dolphins, and Porpoises. Pages 211-216, *In: California's Living Marine Resources and Their Utilization.* W.S. Leet, CM. Dewees, and C.W. Haugen, editors. California Sea Grant Publication UCSGEP-92-12.

LaSalle, M. 1984. Physical and Chemical Alterations Associated with Dredging: An Overview, in: *Effects of Dredging on Anadromous Pacific Coast Fishes.* C.A. Simenstad, Ed. Seattle: University of Washington Press.

Lemberg, N.A., M.F. O'Toole, D.E. Pentilla, and K.C. *Stick.* 1997. 1996 *Forage Fish Stock Status* Report. Washington Department of Fish and Wildlife, Fish Management Program.

Lockheed Ocean Sciences Laboratory. 1983. Distribution and Abundance of Fishes in Central San Diego Bay, California: A Study of Fish Habitat Utilization. Prepared for the Department of the Navy, Naval Facilities Engineering Command under Contract No. N6247482-C1068.

Lockheed Ocean Sciences Laboratory. 1981. Limits of Eelgrass Growth in Southeastern San Diego Bay between the 24th Street Marine Terminal and "Rohr Marsh." Prepared for San Diego unified Port District.

Manning, J. 1993. *Progress Report: Seabird and Waterfowl Censusing at San Diego Bay, California.* Bay and Estuary Program, U.S. Fish and Wildlife Service, Carlsbad, CA.

MBA (Michael Brandman Associates). 1990. *South San Diego Bay Enhancement Plan, Volume 2/ Resources Atlas.* Prepared for San Diego Unified Port District and California Coastal Conservancy.

McDonald, D., I? Dutton, D. Mayer, and K. Merkel. 1994. Review of the Green Turtles of South San Diego Bay in Relation to the Operations of the SDG&E South Bay Power Plant. Document 94-045-01, Prepared for San Diego Gas & Electric Co., C941210311.

McGowan, G.E. 1981. Composition, Distribution, and Seasonality of Ichthyoplankton Populations near an Electricity Generating Station *in South San Diego* Bay, California. *The Early Life History of Fish: Recent Studies.* **165-167.**

Morgan, RP. II, V.J. Rasin, and L.A. Noe. 1973. Effects of Suspended Sediments on the Development of Eggs and Larvae of Striped Bass and White Perch. Ref. No. 73-110. College Park: University of Maryland Natural Research Institute. (Cited in O'Connor 1991.)

NMFS (National Marine Fisheries Service). 1991. Southern California Eelgrass Mitigation Policy. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Region.

NNPP. 1997. Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities, Report NT-97-l.

O'Connor, J.M. 1991. *Evaluation of Turbidity and Turbidity-Related Effects on the Biota of the San Francisco Bay-Delta Estua y.* Submitted to U.S. Army Corps of Engineers, San Francisco District.

Page, G.W., W.D. Shuford, J.E. Kjelmyr, and L.E. Stenzel. 1992. *Shorebird Numbers in Wetlands of the Pacific Flyway: A Summa y of Counts from April 1988 to Janua y 1992.* Point Reyes Bird Observatory, Stinson Beach, CA.

Parametrix. 1995. *USS Missouri Siting Project Summary Data Report: Final Draft.* Prepared for the Kitsap County Economic Development Council by Parametrix, Inc.

Peddicord, R, V. McFarland, D. Belfiori, and T. Byrd. 1975. Dredge Disposal Study, San Francisco Bay and Estuary. Appendix C. Effects of Suspended Solids on San Francisco Bay Organisms. U.S. Army Corps of Engineers, San Francisco District.

Phillips, RC. 1984. The *Ecology of Eelgrass Meadows in the Pacific Northwest: A Community Profile.* Joint publication of the U.S. Fish and Wildlife Service and US. Army Corps of Engineers. FWS/OBS-84/24.

R2 Resource Consultants, *Inc. Winter and Spring Utilization of the Puget Sound Naval Shipyard by Juvenile Salmonids.* Prepared by R2 Resource Consultants, Redmond, WA.

SAIC (Science Applications International Corporation). 1998. *PSNS Benthic Infaunal Data Report.* Prepared by Science Applications International Corporation with assistance by Columbia Science, Royston, B.C.

SAIC. 1995. Final Survey report, April/May and September/October 1994 Marine Sampling and Analysis in Support of Task A Environmental Impact Statement, U.S. Naval Station, San Diego, California. Prepared for the U.S. Navy, Naval Facilities Engineering Command Southwest Division and San Diego Unified Port District.

SAIC. 1994. *Draft Environmental Impact Statement for Dredged Material Disposal, San Diego Bay, California.* Report submitted to Navy Southwest Division, San Diego, CA.

Science Applications International Corporation (SAIC). 1989. History Utilization of Open Water Disposal Sites. Contribution 78. Prepared by SAIC for U.S. Army Corps of Engineers, New England Division, Waltham, MA.

SDG&E (San Diego Gas & Electric Company). 1980. South Bay Power Plant Cooling Water Intake System Demonstration [in accordance with Section 316(b), Federal Water Pollution Control Act Amendment of 1972]. Prepared by SDGEC and the Lockheed Center for Marine Research, San Diego, California, for the San Diego Regional Water Quality Control Board.

SDUPD (San Diego Unified Port District). 1990. South San Diego Bay Enhancement Plan, San Diego, California.

Scott, J., D. C. Rhoads, J. Rosen, S. Pratt, and J. Gentile. 1987. *Impact on Open-Water Disposal of Black Rock Harbor Dredged Material on Benthic Recolonization at the FVP Site.* U.S. Army Corps of Engineers/Environmental Protection Agency. Technical Report D-87-4.

Stadtlander, D. 1994. *Colonial Seabirds and the Western Snowy Plover Nesting in South San Diego Bay,* 1993. Prepared for Bay and Estuary Program, U.S. Fish and Wildlife Service, Carlsbad, CA.

USFWS and DON. 1993 Memorandum of Understanding Between U.S. Fish and Wildlife Service and Southwest Division, Naval Facilities Engineering Command, regarding California Least Terns in San Diego Bay.

WDFW. 1998. Puget Sound Ambient Monitoring Program (PSAMP) Aerial Survey Database and Priority Species Habitat Database. Maintained by the Washington Department of Fish and Wildlife.

WESTEC. 1986. A Study of Fish Habitat Utilization in San Diego Bay from 1984-85. Prepared for Southwest Marine, Inc., San Diego, California, and Huffman Technologies, San Francisco, California.

Weston, D.P. 1990. *Macrobenthic Community Changes in Response to Contaminated Sediments: Sinclair Inlet, Washington.* Prepared for the U.S. Environmental Protection Agency, Region 10.

Zedler, J.B., and C.S. Nordby. 1986. *The Ecology of Tijuana Estuary, California: An Estuarine Profile.* Biology Department, San Diego State University. Prepared for National Coastal Ecosystems Team, Division of Biological Services, Fish and Wildlife Service, U.S. Department of Interior, Washington, D.C., and California Sea Grant College Program, Institute of Marine Resources, University of California A-032, La Jolla, California.

TERRESTRIAL BIOLOGY

Beauchamp, R.M. 1986. *A Flora of San Diego County,* California. National City, CA: Sweetwater River Press.

Bruner, P.L. 1988. A Review of the 1984 Report Entitled: An Avifaunal and Feral Mammal Survey of Lands Involved in the Ford Island Causeway Project, Oahu.

Bruner, P.L. 1989. Survey of the Avifauna and Feral Mammals at Ford Island, Pearl Harbor, oahu.

Char, W.P. 1989a. Botanical Assessment, Ford Island Survey, Naval Base Pearl Harbor.

Char, W.P. 1989b. Botanical Assessment, Ford Island Causeway, Pearl Harbor, Oahu.

DON. *1995. Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft* Carrier. Naval Facilities Engineering Command, Southwest Division.

DON. 1994. *Waterbird Survey, North and Central San Diego Bay,* 2993. Prepared for Naval Air Station North Island, by Southwest Division, Naval Facilities Engineering Command, U.S. Department of the Navy.

DON. 1993. *Draft Supplemental Environmental Impact Statement - Appendices. Element II Breakwater/Pier, Naval Station Everett, Washington State.* Prepared by Pararnetrix, Inc., Kirkland, WA.

DON. 1992a. *Draft Programmatic EIS for Dredged Material Disposal* (from Volume I of 3 volumes). Prepared by the U.S. Department of the Navy, Southwest Division, Naval Facilities Engineering Command, U.S. Department of the Navy.

DON. 1992b. *Supplemental Revised Environmental Impact Statement, 100% Draft Submittal. Element II Carrier Battle Group Homeporting in the Puget Sound Area, Washington State.* Prepared by Parametrix, Inc., Kirkland, WA.

DON. 1992c. *Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S. West Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command. Prepared for Commander, Naval Sea Systems Command.

DON. 1991. *Master Plan 1991. Naval Air Station North Island.* Contract N68711-89-C-00382.

DON. 1990. *Environmental Assessment for the Puget Sound Naval Shipyard Commissary Store. Western Division Naval Facilities Engineering Command. San Diego,* CA.

DON. 1986. Natural Resources Management Plan for the Bremerton Naval Complex, Bremerton, Washington. Western Division Naval Facilities Engineering Command. San Diego, CA.

DON. 1985. Final Environmental Impact Statement. Carrier Battle Group (CVBG), Homeporting in the Puget Sound Area, Washington State.

Franklin, J.F., and C.T. Dyrness. 1969. Vegetation of Oregon and Washington. USDA Forest Service Research Paper PNW-80.

Hall, E.M. 1984. Vegetation and Environmental Effects Associated with the Proposed Ford Island Causeway, Oahu, Hawaii.

USFWS. 1994. Determination of Endangered Status for the Pacific Pocket Mouse: Final Rule. Federal Register, September 29.

WDFW. 1998. Puget Sound Ambient Monitoring Program (PSAMP) Aerial Survey Database and Priority Species Habitat Database. Maintained by the Washington Department of Fish and Wildlife.

LAND USE

City of Bremerton. 1991. Zoning Maps - Bremerton, Washington.

City of Bremerton. 1995. *City of Bremerton Comprehensive Plan -- Land Use Element.*

City of Coronado. 1987. *City of Coronado General Plan -- Land Use Element.*

City of Everett. 1994. *City of Everett Comprehensive Plan.* Department of Planning and Community Development.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. 1995b. *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1994. *Naval Station Everett Master Plan.* Engineering Field Activity Northwest.

DON. 1992. *Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S.* West Coast *Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command. Prepared for Commander, Naval Sea Systems Command.

DON. 1991. *Master Plan 1991. Naval Air Station North Island.* Contract N68711-89-C-0038.

DON. 1989. *Master Plan — Bremerton Naval Complex.* Western Division, Naval Facilities Engineering Command.

DON. 1984. *Air Installations Compatible Use Zone (AICUZ) Study - NAS North Island.* Naval Facilities Engineering Command, Southwest Division.

Snohomish *County.* 1994. *Draft Snohomish County Comprehensive Plan General Policy Plan.*

SOCIOECONOMICS

DON. 1991. *Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S.* West *Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command. Prepared for Commander, Naval Sea Systems Command.

DBEDT (Hawaii State Department of Business, Economic Development, and Tourism). 1996. *The State of Hawaii Data Book, 1995.*

NAFIS (National Association of Federally Impacted Schools). 1997. NAFIS's Impact Aid Bluebook, 1996-1997 Edition. Washington, D.C.

NAFIS. 1996a. NAFIS's Impact Aid Bluebook 1995-1996 Edition. Washington, D.C.

NAFIS. 1996b. NAFIS's Impact Aid Handbook Valid Through 1999. Washington, D.C.

SMS Research and Marketing Inc., and The Prudential Locations, Inc. 1997 The Hawaii Housing Policy Study Update, 1997. Prepared for the Convention of Public and Private Housing Developers, State of Hawaii.

The Prudential Locations, Inc. 1997. O'ahu Military Housing Market Analysis. Prepared for U.S. Navy. Honolulu, HI.

U.S. Bureau of Economic Analysis, Regional Economic Information System. 1995.

U.S. Department of Commerce, Bureau of the Census. 1992. CD-ROM, 1990 Census of Population and Housing, Summary Tape File 1A, September.

US. Department of Housing and Urban Development. 1997. Economic Report, First Quarter 1997.

TRANSPORTATION

Christofferson, QMC Chief. 1997. "Record of Phone Conversation." **NAVSTA Port Operations.**

DON. 1997a. ***Homeport Analysis*** *for* ***Developing Home Port Facilities*** *for* ***Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet. Comman***der, Naval Air Force, U.S. Pacific Fleet.

DON. 1997b. Cross Sound Transportation in Support of USS **ABRAHAM** LINCOLN 1999 Planned Incremental Availability. COMNAVAIRPAC ACOS PACNORWEST **Memo 19** December.

DON. 1995a. ***Final Environmental Impact Statement for the Development Of Facilities in San Diego/Coronado to Support the Homeporting*** *of* ***One NIMITZ Class Aircraft Carrier.*** **Naval** Facilities Engineering Command, Southwest Division.

DON. 1995b. ***Environmental Assessment*** *for* ***Homeporting*** *of* ***an Aircraft Carrier and Construction*** *of* ***Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.***

DON. 1995c. Office of the Secretary. Ship Depot Maintenance Solicitation Policy. Memo of 16 June.

DON. 1990. Final Environmental Impact Assessment for Proposed Developments at Naval Base Pearl Harbor, Oahu, Hawaii. Pacific Division Naval Facilities Engineering Command.

Linscott, Law and Greenspan. 1997. Traffic Impact Analysis NASNI Third Street Gate. Prepared for the City of Coronado.

Milbauer, John. 1997. Record of Conversation. All Ships Cargo.

SANDAG. 1998. San Diego-Coronado Bridge Toll Removal Impact Study. Draft Report. Prepared for the City of Coronado.

SDUPD. 1993. *Port Master Plan.* Amended.

SDUPD. *1992. Port Master Plan.*

Transportation Research Board. 1994. *Highway Capacity Manual.*

AIR QUALITY

Booz, Allen, Hamilton. 1991. *Inventory of Air Pollutant Emissionsfrom Marine Vessels.*

California Air Resources Board. *1997. EMFAC7G Mobile Source Emission Factor Model.* Technical Support Division.

DON. 1997a. *Air Emissions Invento y Prediction for Naval Station Everett and Family Support Complex at Full Operation.* Prepared for NAVSTA Everett, Public Works Environmental. Prepared by Engineering Field Activity Northwest, Environmental Technical Department.

DON. 1997b. *Puget Sound Naval Shipyard's Air Emissions Inventory Report for Calendar Year 1996.* Submitted to the PSAPCA, Registration No. 14082.

DON. 1997c. *Environmental Assessment for Proposed Lease of Land at Naval Base Pearl Harbor for the USS MISSOURI Memorial.* Pacific Division, Naval Facilities Engineering Command. September.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/ Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. *1995b. Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1995c. *Air Emissions Inventory for Naval Station Everett for Title V Permit Determination.* Prepared for NAVSTA Everett, Public Works Environmental. Prepared by Engineering Field Activity Northwest.

EPA. 1995. *Compilation of Air Pollutant Emission Factors - AP-42, Volume I.*

EPA. 1993. *MOBILE5 Mobile Source Emission Factor Model.* Hawaii Department of Health. 1993. Hawaii Administrative Rules (HAR), Title 11, Chapter 59, Air Quality Standards.

National Weather Service. 1997a. *Bremerton, Washington Period of Record Monthly Climate Summary,* site number 450872. Data obtained from Western Regional Climate Center. Period of record from 6/1/48 to 12/31/96.

National Weather Service. 1997b. Everett, Washington Period of Record Monthly Climate Summary, site number 452675. Data obtained from Western Regional Climate Center. Period of record from 6/1/48 to 1/31/97.

NNPP. 1997. Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities, Report NT-97-l

PSAPCA (Puget Sound Air Pollution Control Agency). 1997a. Hourly Surface Winds for Hoyt Avenue and 25th Street, Everett, Washington, 1995. PSAPCA. 1997b. *Redesignation Request and Maintenance Plan for the National Ambient CO Standard.*

PSAPCA. 1996. *Central Puget Sound Region Redesignation Request and Maintenance Plan for the National Ambient CO Standard.*

PSAPCA. *1995. Central Puget Sound Region Redesignation Request and Maintenance Plan for the National Ambient 03 Standard.*

Radian International LLC. 1998. *Final 1997 Emission Invento y Report for CVN Construction and Dredging Activities Naval Air Station, North Island.* **Prepared for Southwest Division Naval Facilities Engineering Command.**

SDCAPCD. 1999. *San Diego County Air Pollution Control District Rules and Regulations.*

SDCAPCD. *1996. San Diego County Redesignation Request and Maintenance Plan for the National Ambient CO Standard.*

U.S. Naval Aviation Depot, North Island. *1997. Health Risk Assessment Report for Naval Air Station, North Island.* **Prepared by Pentech Services, Inc. Delivery order 0015 of contract N00123-93-D-5155.**

NOISE

City of Bremerton. 1996. City of Bremerton Municipal Code, Chapter 6.32 — Noise Levels.

City of Coronado. 1987. *City of Coronado **General Plan** -- Noise Element.*

City of Everett. 1994. City of Everett Municipal Code, Chapter *20.08* **— Noise Control.**

Construction Engineering Research Laboratory (CERL). 1975. *Construction Noise: Specification, Control, Measurer&t, and Mitigation.* **Technical Report E-53.**

DOD. 1978. *Planning in the Noise Environment.* **NAVFAC P-970 document.**

DON. 1998. Letter from T.M. Boothe, Captain, CEC, U.S. Navy, Assistant Chief of Staff for Infrastructure Planning to Homer L. Bludau, City Manager, City of Coronado. Dated November 30, 1998.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* **Naval Facilities Engineering Command, Southwest Division.**

DON. 1995b. *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities -- Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1995c. *Environmental and Natural Resources Program Manual.* **OPNAVINST 5090.1b.**

DON. 1991. *Master Plan 1991. Naval Air Station North Island.* Contract N68711-89-C-0038.

HDOH (Hawaii Department of Health). 1996. Hawaii Administrative Rules, Chapter 46 Community Noise Control, Title 11.

Investigative Science and Engineering. 1998. "P549/700 Noise Monitoring Project." Letter report from Rick Tavares, Project Principal, Investigative Science and Engineering to John Coon, Project Management, Southwest Division, NAVFACENGCOM. September 21.

Linscott, Law & Greenspan Engineers. 1994. *Traffic Impact Analysis NIMITZ Class Aircraft Carrier Homeporting -- Naval Air Station North Island -- San Diego, California.*

RECON. 1998. *City* of *Coronado Noise Study* - 1998. Prepared by Charles S. Bull of RECON, noise consultant to the City of Coronado. October 9.

AESTHETICS

DON. 1995a. *Final Environmental Impact Statement* for *the Development* of *Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. 1995b. Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.

DON. 1991. *Master Plan 1991. Naval Air Station North Island.* Contract N68711-89-C-0038.

DON. 1989. *Master Plan — Bremerton Naval Complex.* Western Division, Naval Facilities Engineering Command.

DON. 1986. *Naval Station Puget Sound Master Plan.* Western Division Naval Facilities Engineering Command.

SDUPD. 1980. Final Environmental Impact Report on the Port Master Plan, San Diego Unified Port District. Environmental Management Department.

CULTURAL RESOURCES

Abbott, D.W., and L. Larson. 1984. *Archaeological and Historical Cultural Resources Survey of the Port Gardner Area, Everett, Washington. BOAS:* Seattle, WA.

Abeyta, Daniel. 1999. Letter of Concurrence Regarding Proposed Action's No Effect on Historic Properties. Acting State Historic Preservation Officer, February 22.

Chambers Consultants and Planners. 1982. *The Cultural Resources of Naval Air Station, North Island and Outlying Landing Field, Imperial Beach, San Diego County, California.* Prepared for the Staff Civil Engineer, Naval Air Station North Island.

Dodds, G.B. 1986. The *American Northwest: A History of Oregon and Washington.* Arlington Heights, Illinois: The Forum Press, Inc.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* **Naval Facilities Engineering Command, Southwest Division.**

DON. **1995b.** *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1992. *Programmatic Environmental Impact Statement: Fast Combat Support Ship (AOE-6 Class) U.S.* **West** *Coast Homeporting Program.* **Naval Facilities Engineering Command, Chesapeake Division.**

DON. **1991.** *Master Plan 1991. Naval Air Station North Island.* **Contract** N68711-89-C-0038.

DON. 1989. *Master Plan for Puget Sound Naval Shipyard.* **Naval Facilities Engineering Command.**

DON. **1986.** *Master Plan for Naval Station Puget Sound.* **Everett, WA.** CH2M Hill.

DON. **1985.** *Final Environmental Impact Statement for the Carrier Battle Group Puget Sound Region Homeporting Project.* Parametrix.

DON. 1978. Historic Preservation Plan, Pearl Harbor Naval Complex.

Grulich Architecture and Planning Services. 1986. Historic Survey: Puget Sound Naval Shipyard, Bremerton, Washington. Submitted to the DON by Grulich Architecture and Planning Services under Contract No. N 62474-85-C-9967. Tacoma, Washington.

Luomala, K. 1978. Tipai and Ipai. In *California,* **ed. RF. Heizer, pp. 592-609. Handbook of North American Indians, vol. 8. Washington, D.C.: Smithsonian Institution.**

Moratto, M.J. 1984. *California Archaeology. New York:* Academic Press.

Suttles, W., ed. 1990. *Northwest Coast.* **Handbook of North American Indians,** *No.* **7. Washington, D.C.: Smithsonian Institution.**

Washington State Office of Archaeology and Historic Preservation. 1987. *Resource Protection Planning Process Southern Puget Sound Study Unit.* **Olympia: Washington State Office of Archaeology and Historic Preservation.**

Yatsko, A. 1990. National Register Forms for the Naval Air Station, San Diego Historic District.

GENERAL SERVICES/ACCESS

DON. **1995a.** *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* **Naval Facilities Engineering Command, Southwest Division.**

DON. **1995b.** *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. **1991.** *Master Plan 1991. Naval Air Station North Island.* **Contract** N68711-89-C-0038.

HEALTH AND SAFETY

DON. 1997. PWC San Diego, e-mail dated August 25. Part B Permit Information

DON. 1996a. NASNIINST. 5100.4B dated 14 Feb 1996. *NAS North Island Occupational Safety and Health Program Manual.*

DON. 1996b. NAVSTAEVERE'ITINST. 5100.5, *Activity Safety Manual.*

DON. 1996c. PSNS SECNAV Award "Achievement *is* Safety Ashore," *Large Industrial Activity.*

DON. 1996d. Work Plan for Unexploded Ordnance (UXO) Location and Removal, NAS North Island, San Diego, CA. Prepared by Wyle Laboratories for Navy SOUTHWEST NAVFACENGCOM, San Diego.

DON. 1995. NAVSHIPYDPUGETINST P5100.66A, Rev A, March 1995, *Shipyard Occupational Safety and Health Manual.*

DON. 1994. OPNAVINST. 5100.23D dated 11 October 1994. *Navy Occupational Safety and Health (NAVOSH) Program Manual.*

NNPP. 1997a. Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities, Report NT-97-l.

NNPP. 1997b. *Occupational Radiation Exposure From U.S. Naval Nuclear Plants and Their Support Facilities,* Report NT-97-2.

UTILITIES

DON. 1997. *Homeport Analysis for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet.* Commander, Naval Air Force, U.S. Pacific Fleet.

DON. 1996. *Naval Shipyard Electrical Utility Technical Study Pearl Harbor.*

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. 1995b. *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1994. Aircraft Carrier Emission Information. NAVFAC ltr Ser 232.RH/0944 dated 17 March.

DON. 1993. Facilities Assessment, Pearl Harbor. PACDIV.

DON. 1992. *Programmatic Environmental Impact Statement, Fast Combat Support Ship (AOE-6 Class), U.S. West Coast Homeporting Program.* Chesapeake Division, Naval Facilities Engineering Command. Prepared for Commander, Naval Sea Systems Command.

DON. 1991. ***Master Plan 1991. Naval Air Station North Island.*** Contract N68711-89-C-0038.

DON. 1989. ***Master Plan Bremerton Naval Complex.*** Western Division, Naval Facilities Engineering Command.

DON. 1988. Military Handbook, Dockside Utilities for Ship Service. MIL-HDBK-1025/2.

ENVIRONMENTAL JUSTICE

BIA (Bureau of Indian Affairs), U.S. Department of the Interior. 1979. Background Information on Indian Fishing Rights in the Pacific Northwest. Prepared in cooperation with the U.S. Fish and Wildlife Service, U.S. Department of the Interior, and the Northwest Indian Fisheries Commission.

BIA. 1978. Usual and Accustomed Fishing Places of Certain Western Washington Treaty Tribes Adjudicated ***in United States v. Washington*** No. 9213, January 1, 1977.

CEQ. ***1997. Guidance for Addressing Environmental Justice under the National Environmental Policy Act (NEPA).***

COE. 1988. ***Final Environmental Impact Statement — Unconfined Open Water Disposal Sites for Dredged Material, Phase*** I ***(Central Puget Sound).*** Puget Sound Dredged Disposal Analysis Program. Seattle, Washington.

COE. 1986. ***Final Supplement Environmental Impact Statement. Carrier Battle Group (CVBG) Homeporting in the Puget Sound Area, Washington State.*** Seattle District.

DON. 1995a. ***Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft*** Carrier. Naval Facilities Engineering Command, Southwest Division.

DON. ***199%. Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.***

EPA. ***1994. Environmental Justice Task Force Draft Final*** Report. Office of Solid Waste and Emergency Response (OSWER).

DBEDT (Hawaii State Department of Business, Economic Development, and Tourism). 1996. *The State of Hawaii Data Book, 1995.*

U.S. Department of Commerce, Bureau of the Census. 1991. 1990 Census of Population and Housing, Summary Tape File 1-A: Alaska, Hawaii, Oregon. CD90-3A-02. Washington, DC.

CUMULATIVE IMPACTS

Clark, ***Norman*** H. 1970. ***Mill Town, A Social History of Everett, Washington.*** Seattle: University of Washington Press.

Copper, E. and R. Patton. 1998. The Status of California Least Tern at Navy Bases on San Diego Bay in 1997. Prepared for Southwest Division, Naval Facilities Engineering Command, San Diego.

DON. 1998. Environmental Assessment for Retention of Submarine Maintenance Capability in Naval Port San Diego with the Decommissioning of USS McKee. September.

DON. 1997. Environmental Assessment for Proposed Lease of Land at Naval Base Pearl Harbor for the USS MISSOURI Memorial. Pacific Division, Naval Facilities Engineering Command. September.

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

DON. 1995b. *Environmental Assessment for Homeporting of an Aircraft Carrier and Construction of Associated Support Facilities. Puget Sound Naval Shipyard, Bremerton, Washington.*

DON. 1995c. Environmental Assessment for Modifications to the Design of the Ford Island Bridge, NAVSTA Pearl Harbor. Prepared by Belt Collins Hawaii.

DON. 1991. *Master Plan 1991. Naval Air Station North Island.* Contract N68711-89-C-0038.

NMFS (National Marine Fisheries Service). 1991. Southern California Eelgrass Mitigation Policy. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Region.

SANDAG (San Diego County Association of Governments). 1998. Draft San Diego-Coronado Bridge Toll Removal Impact Study.

SAIC. 1998. The State of San Diego Bay: What Users Need to Know. An Environmental White Paper. Prepared for the San Diego Port Tenants Association.

Valkirs, A., P. Se&man, J. Grovhoug, R. Fransham, B. Davidson, and L. Kear. 1995. U.S. Navy Statutory Monitoring of Tributyltin in Selected U.S. Harbors. Prepared for U.S. Naval Sea Systems Command and U.S. Environmental Protection Agency.

CHAPTER 7.0 RADIOLOGICAL ASPECTS OF AIRCRAFT CARRIER HOMEPORTING

Boice, Jr., J.D. 1990. Studies of Atomic Bomb Survivors, Understanding Radiation Effects. Journal *of the American Medical Association.*

CFR (Code of Federal Regulations). 1992. *National Emissions Standards for Hazardous Air Pollutants,* 40 CFR, Part 61, Subpart I, July 1.

CFR. 1994. *Standards For Protection Against Radiation.* 10 CFR Part 20.

Charpemtier, P., et al. 1993. The Mortality of U.S. Nuclear Submariners, 1969-1982. *Journal of Occupational Medicine* 35(5):501-509.

Croff, A. G. 1980. *A User's Manualfor the ORIGEN2 Computer Code.* ORNL/TM-7175. Oak Ridge National Laboratory.

Crouch, E.A.C. and R. Wilson. 1982. *Risk/Benefit Analysis.*

DOE/DOD (U.S. Department of Energy and U.S. Department of Defense). 1993. *The United States Naval Nuclear Propulsion Program.*

DON. 1995. *Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier*

Duncan, F. *1990. Rickover and the Nuclear Nay: The Discipline of Technology.*

EPA. 1972. Radiological Surveys of Pearl Harbor, Hawaii, and Environs, 1966-68. *Radiation Data and Reports* 13(6):323-386.

EPA. *1977. Radiological Survey of Puget Sound Naval Shipyard Bremerton, Washington, and Environs,* 520/5-77-001.

EPA. 1987a. Radiation Protection Guidance to Federal Agencies for Occupational Exposure. *Federal Register* 52(17) 2822.

EPA. 1987b. *Radiological Survey of the Pearl Harbor Naval Shipyard and Environs, Honolulu, Hawaii,* 520/5-87-010.

EPA. 1989a. *Radiological Survey of San Diego Bay,* 520/5-88-019.

EPA. 1989b. *Radiological Survey of Naval Facilities on Puget Sound.* 520/5-88-016

FRC (Federal Radiation Council). 1960. Radiation Protection Guidance for Federal Agencies. *Federal Register* 25(97) *18* May: 4402.

Ganti, C.S., and L.M. Kramer. 1984. *Nay Fire Risk Management: A Methodology for Prioritizing Fire Protection Recommendations.* Factory Mutual Research.

GAO (US. General Accounting Office). 1991. *Nuclear Health and Safety: Environmental, Health, and Safety Practices at Naval Reactors Facilities,* GAO/RCED-91-157.

Greenburg, E.R., et al. 1985. An Investigation of Bias in a Study of Nuclear Shipyard Workers. *American Journal of Epidemiology* 121: 301-308.

Hatch, M.C. et al. 1990. Cancer Near the Three Mile Island Nuclear Plant: Radiation Emissions. *American Journal of Epidemiology.* September.

Hewlett, R.G., and F. *Duncan.* 1974. *Nuclear Nay, 1946-1962.*

House of Representatives. 1979. Committee on Science and Technology. Nuclear Powerplant Safety Systems: Hearings before the Subcommittee on Energy Research and Production of the Committee on Science and Technology. *96th Cong., 1st sess., 22-24 May.*

ICRP (International Commission on Radiological Protection). *1959. Recommendations of the International Commission on Radiological Protection,* **Publication 1.**

ICRP. *1964. Recommendations of the International Commission on Radiological Protection,* **Publication** 6.

ICRP. **1977.** *Report of the Task Group on Reference Man. Recommendations of the International Commission on Radiological Protection,* **Publication 26.**

ICRP. 1979. Limits for Intakes of Radionuclides by Workers, Part 1. *Annals of the ICRP 2(3/4),* **Publication 30**

ICRP. 1991. The 1990 Recommendations of the International Commission on Radiological Protection. *Annals of the ICRP* 21(1-3), **ICRP Publication 60.**

KAPL (Knolls Atomic Power Laboratory). 1993a. *Deep Sea Radiological Environmental Monitoring Conducted at the Site of the Nuclear-Powered Submarine SCORPION Sinking,* **KAPL-4749. By R.B. Sheldon and J.D. Michne.**

KAPL. 1993b. *Deep Sea Radiological Environmental Monitoring Conducted at the Site of the Nuclear-Powered Submarine THRESHER Sinking,* **KAPL-4748. By RB. Sheldon and J.D. Michne.**

Matanoski, G.M. 1991. *Health Effects of Low Level Radiation in Shipyard Workers.* **Prepared by Johns Hopkins University for the U.S. Department of Energy.**

Napler, B.A., RA. Peloquin, D.L. Strenge, J. V. Ramsdell. 1988. *GENII The Hanford Environmental Radiation Dosimety Software System,* **PNL-6584, UC-600.**

NAS-NRC (National Academy of Sciences - National Research Council). 1972. The Effects on Populations of Exposure to Low Levels of Ionizing Radiation. *Report of the Advisory Committee on the Biological Effects of Ionizing Radiations.*

NAS-NRC. 1980. The Effects on Populations of Exposure to Low Levels of Ionizing Radiation. *Report of the Committee on the Biological Effects of Ionizing Radiation.*

NASNRC. 1990. Health Effects of Exposure to Low Levels of Ionizing Radiation. BEIR V. *Report of the Committee on the Biological Effects of Ionizing Radiations.*

NCI (National Cancer Institute). *1990. Cancer in Population Living Near Nuclear Facilities.* NIH **Publication No. 90-874**

NCRPM (National Council on Radiation Protection and Measures). 1954. Permissible Dose from External Sources of Ionizing Radiation, Report 17.

NCRPM. 1959. *Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and Water for Occupational Exposure,* **Report No. 22.**

NCRPM. 1987a. *Radiation Exposure of the U.S. Population from Consumer Products and Miscellaneous Sources,* **Report No. 95.**

NCRPM. 1987b. *Exposure of the Population in the United States and Canada from Natural Background Radiation,* Report No. 94.

NCRPM. 1987c. Recommendations on Limits for Exposures to **Ionizing** Radiation, Report *No.* 91.

NCRPM. 1989a. *Exposure of the U.S. Population from Occupational Radiation,* Report No. 101.

NCRPM. 1989b. *Exposure of the U.S. Population from Diagnostic Medical Radiation,* Report No. 100.

NNPP (U.S. Department of the Navy, Naval Nuclear Propulsion Program). 1997a. Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear Powered Ships and Their Support Facilities, Report NT-97-1

NNPP. 1997b. *Occupational Radiation Exposure From U.S. Naval Nuclear Plants and Their Support Facilities,* Report NT-97-2.

NRC (Nuclear Regulatory Commission). *1977. US NRC Final Environmental Statement on the Transportation of Material by Air and other Modes. NUREG0170.*

NRC. 1996. Occupational Radiation Exposures at Commercial Nuclear Power Reactors and Other Facilities - 1994, NUREG-0713 16.

NSC (National Safety Council). 1993. *Accident Facts,* 1993 Edition

Ostfeld, A.M. et al.. 1987. *Out-of-Service Mortality Among Nuclear Submariners Discharged 1969-1981.* Yale University School of Medicine.

PHS (U.S. Public Health Service). 1966. *Radiological Survey of Pearl Harbor, Hawaii, and Vicinity.*

PHS. 1968. *Radiological Survey of Major* ***California Nuclear Ports.*** PB 178728.

Rinsky, R.A., et al. 1981. Cancer Mortality at a Naval Nuclear Shipyard. *The Lancet,* January 31.

Rinsky, RA., et al. 1988. Case-Control Study of Lung Cancer in Civilian Employees at the Portsmouth Naval Shipyard, Kittery, Maine. *American Journal of Epidemiology* 127:55-64.

Shimizu, Yukiko, et al. 1990. Cancer Risks among Atomic Bomb Survivors, the RERF Life Span Study. *Journal of the American Medical Association.* August 1.

Shore, R.E. 1990. Occupational Radiation Studies, Status, Problems, and Prospects. *Health Physics.* July

Stem, F.B., et al. 1986. A Case-Control Study of Leukemia at a Naval Nuclear Shipyard. *American Journal of Epidemiology* 123: 980-992.

UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation). 1972. *Ionizing Radiation: Levels and Effects.*

UNSCEAR. 1988. *Sources, Effects, and Risks of Ionizing Radiation.*

Upton, A.C. 1982. The Biological Effects of Low-Level Ionizing Radiation. *Scientific American 26* (February): 41-49.

Wallace, O.J. *1972. SPAN-A Point Kernel Computer Program for Shielding,* WAPD-TM-809(L). 2 vols. Bettis Atomic Power Laboratory, Pittsburgh, PA.

Wenzel, D.R. 1994. *The Radiological Safety Analysis Computer Program (RSAC-5).* U.S. DOE Report WINCO-1123. Westinghouse Idaho Nuclear Company, Inc. Idaho Falls, Idaho. October.

1

14.0 PERSONS AND AGENCIES CONTACTED

Abina, LT. J.G. 1997. COMNAV Base Seattle.

Arden, Hiram. 1998. Environmental Planner, Seattle Corps of Engineers. Seattle, Washington

Ament, S. 1998. Washington Department of Fish and Wildlife, Sequim, Washington. October 26.

Briggs, Bill. 1999. Land Use Planning, Port of San Diego.

Brock, Gerald. 1997. Assistant Superintendent for Finance and Operations, North Kitsap School District, Poulsbo, Washington.

Brydges, Gail. 1999. City of Coronado, California.

Burt, Donna. 1997. EFANW.

Casora, Jose. 1997. NASNI.

Clement, Larry. 1997. Executive Director for Finance and Operations, Marysville School District, Marysville, Washington.

Collins, W. 1997. Southwest Division South Bay Area Focus Team, Environmental Engineer.

Combs, James. 1998. Land Use Specialist, City of Bremerton Permitting Department. Bremerton, Washington.

COMNAV Surface Group, Pacific Northwest Operations. 1997.

Coon, John. 1997. CVN Homeporting Coordinator. Southwest Division, Naval Facilities Engineering Command, San Diego.

Cozakos, Athena. 1997. Environmental Department Head, Navy Public Works Center, San Diego.

Curry, Monica. 1999. Engineer, San Diego Gas & Electric.

Decker, Cindy. 1997. Assistant Superintendent for Business Services, Bainbridge Island School District, Bainbridge Island, Washington.

Dezotell, David. 1997. Engineering Draftsman, Code 416 (Planning and Engineering), Public Works, NAVSTA Everett, July 9, 1997.

Draper, Walt. 1997. Director of Finance and Operations, Bremerton School District, Bremerton, Washington.

Dye, John. 1999. Engineer, Southwest Division Naval Facilities Engineering Command, San Diego.

Englesby, Steve. 1997. Planner, City of Everett.

Evanson, J. 1998. Washington Department of Fish and Wildlife, Olympia, Washington. November 16.

Forkenbrock, John. 1997. Executive Director, National Association of Federally Impacted Schools (NAFIS), Washington, DC.

Forys, Dr. Karen. 1997. Superintendent, Northshore School District, Bothell, Washington.

Fountain, Donn. 1997. Executive Director of Business, South Kitsap School District, Silverdale, Washington.

Fuller, David. Suquamish Tribal Geologist.

Goff, T. 1997. Seaworld Marine Mammal Curator.

Grayson, Gary. 1997. Public Works Department, NAVSTA Everett.

Gregoir, Dennis. 1998. Port of Everett Planning Department. Everett, Washington.

Herold, Debbie. 1997. Public Works Department, NAVSTA Everett.

Hintzman, Jan. 1997. Acting Assistant Director, Facilities Planning Department, San Diego Unified School District, San Diego, California.

Hoffman, R National Marine Fisheries Service, San Diego, California.

Husson, Bruce. 1997. Assistant Superintendent for Business Services, San Diego Unified School District, San Diego, California.

Irvine, Jerry. 1998. Planner, City of Everett. Everett, Washington.

Jallo, C. 1997. Environmental Analyst, Ogden Environmental Services.

Jeffery, Jai. 1997. Engineering Field Activity, Northwest.

Kelley, Lt. Steven. 1997. N41 COMNAVBASE, Pearl Harbor.

Meeman, Ed. 1999. Senior Planner, City of Coronado.

Kole, Ron. 1999. Supervising Public Information Officer. San Diego Municipal Sanitary District.

Krauss, J.C. 1998. Dredging Manger, Dutra Dredging Company.

Mach, Rich. 1997. Southwest Division South Bay Area Focus Team, Environmental Engineer.

Magee, Mike. 1997. Installation Restoration Manager, NASNI.

Maher, Eileen. 1998. Planner, Port of San Diego Environmental and Planning Department. San Diego, CA.

Matta, Mike. 1997. Public Works Environmental Division Director, Naval Station Everett.

McCay, Patrick. 1999. Southwest Division South Bay Area Focus Team.

McKeighen, Bill. 1997. Budget and Finance Manager, Edmonds School District, Lynnwood, Washington.

Mitchell, Arlene. 1997. Fiscal Services Coordinator, Coronado Unified School District, San Diego, California.

MWR. 1997.

Naval Clinic Command. 1997.

NAVSTA Port Ops Chief Quartermaster. 1997.

Newman, Captain Roger. 1997. USN (Ret.).

Nysewander, D. 1998. Washington Department of Fish and Wildlife, Olypmia, Washington. October 19.

Ochoa, Sal. 1999. Project Architect, Port District of San Diego.

Pagliaro, Jesse. Process Control Supervisor, Point Loma Metropolitan Wastewater Treatment Facility.

Pentilla, D.E. 1998. Washington Department of Fish and Wildlife, Region 4 Marine Resources. October 19.

Perdue. 1999. Department of the Navy.

Pitchford, Clark. 1997. PSNS Bremerton air programs manager.

Powell, Gary. 1997. Assistant Superintendent for Business and Operations, Central Kitsap School District, Silverdale, Washington.

Price, Larry. 1997. Director of Facilities, Marysville School District, Marysville, Washington.

Read, R. California Department of Fish & Game. Telephone conversation with D. Heilprin (SAIC).

Reyes, R. 1997. Justice and Associates.

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Selnick, C. 1997. SDCAPCD.

Sizemore, B. 1998. Washington Department of Fish and Wildlife - Point Whitney Shellfish Laboratory. October 23.

Snyder, S. 1998. Washington Department of Fish and Wildlife, Olympia, Washington.

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Final Environmental Impact Statement for

Developing Homeporting Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet

Coronado, California • Bremerton, Washington
Everett, Washington • Pearl Harbor, Hawaii

VOLUME 2

General Appendices

July 1999

Department of the Navy

APPENDIX A

RELEVANT FEDERAL, STATE, AND LOCAL STATUTES, REGULATIONS, AND GUIDELINES

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RELEVANT FEDERAL, STATE, AND LOCAL STATUTES, REGULATIONS, AND GUIDELINES

Procedures for the implementation of NEPA by the Department of the Navy are contained in 32 C.F.R. §775 (1997) and in OPNAVINST 5090.1B. The instruction contains policy and guidance to ensure that Navy actions with the potential to have significant environmental impacts are accomplished pursuant to the letter and spirit of NEPA. Application of the instruction ensures that a full and unbiased discussion of significant environmental impacts is addressed in this EIS and that decisionmakers and the public are informed of the reasonable alternatives for the proposed CVN homeporting that will avoid or minimize adverse impacts or enhance the quality of the human environment.

LAND USE

Federal

Coastal Zone Management Act of 1972, 16 U.S.C.A. §§ 1452 to 1465 (West 1985 & Supp. 1997). This Act declares a national interest in the effective management, beneficial use, protection, and development of the coastal zone. It indicates that the primary responsibility for planning and regulation of land and water uses rests with the state and local governments. The Act establishes procedures and inducements to coastal states to develop and enforce management plans for the sound use (i.e., preservation) of coastal resources. Since 1990, state management plans must also address non-point source water pollution in the coastal zone. Federal activities that could affect a land or water use, or a natural resource of the coastal zone, must be consistent with the enforceable policies at the approved state coastal zone program to the maximum extent practicable. Because the project would directly affect the coastal zone, the Navy has been coordinating with the California Coastal Commission, Washington State Department of Ecology, and Hawaii Coastal Zone Management Program. A draft Coastal Consistency Determination (CCD), as required by this Act, has been prepared for this project and reviewed by the Commission.

Exec. Order No. 12,372 (Intergovernmental Review of Federal Programs), 47 Fed. Reg. 30,959 (1982). This order directs federal agencies to make efforts to 'accommodate state and local elected officials' concerns regarding federal development. It requires that agencies consult with and solicit comments from state and local officials whose jurisdictions would be affected by the federal action.

U.S. Department of Defense, Hawaii Military Land Use *Plan (1995).* Plans for DoD military-controlled land in Hawaii for the next 10 to 20 years are contained in this outline. The land use plan is the result of a study initiated by the Commander in Chief, U.S. Pacific Command to review military land requirements and existing military landholding in Hawaii by all military services. The objectives were to develop a coordinated, comprehensive plan to accommodate foreseeable missions and force levels and to identify lands to be retained or declared excess, and if necessary, acquired. This study supports retaining most of the DoD-controlled lands and identifies about 10,600 acres for potential sale, exchange, or release.

State

California Coastal Act of 1976, Cal. Pub. Res. Code §§ 30000 to 30900 (Deering 1996 & Supp. 1998). This Act provides long-term protection of the California coastline. The structure of the Act is based upon recommendations in the California Coastal Plan adopted by the Coastal Commission in 1975. The policies include requirements for the following:

- Protection and expansion of public access to shoreline and recreational opportunities and resources;
- Protection, enhancement, and restoration of environmentally sensitive shoreline habitats;
- Protection of productive agricultural lands, commercial fisheries, and archaeological resources; and
- Provisions for expansion of existing industrial ports and electricity-generating poser plants.

Shoreline Management Act of 1971, Wash. *Rev. Code Ann. § 90.58. 010 to 9059.920 (West 2992 & Supp. 1 998), and its implementing regulations in* Wash, *Admin. Code Ch. 173-l 6 (1997 & Supp. 1998).* This Act was established as directed by the Coastal Zone Management Act of 1972, and it provides a management plan for the long-term use and protection of coastal resources.

Coastal Zone Management Act, Haw. Rev. Stat. §§ 205A-1 to 205A-64 (1993 & Supp. 1996). This Act requires federal agencies to conduct activities directly affecting the coastal zone in a manner consistent, to the maximum extent practicable, with State Coastal Zone Management Act programs.

Local

Master Plan, Naval Air Station North Island (NASNI), San Diego, *California* (1991). The NASNI Master Plan is an update of the Station's 1978 Master Plan, and it provides an overview of existing conditions and presents concepts and recommendations for future development at NASNI.

City of Coronado General Plan, Land Use Element (1987). This document defines categories of land use within the City of Coronado. Lands within the city and adjacent to NASNI's southeastern boundary are designated and zoned by the city primarily for varying densities of residential development. NASNI is not under the land use jurisdiction of the city, but rather the city's designations for NASNI are advisory.

Master Plan, Puget Sound Naval Shipyard (PSNS), Bremerton Naval Complex, Bremerton, Washington (1988) and Addendum (1994). In order to accommodate for the limited space at this facility, this plan utilizes a set of Engineering Evaluations and Basic Facility Requirements to provide a framework for long-term land use planning at PSNS Bremerton.

City of Bremerton Comprehensive Plan Land Use Element (1986). Land use designations for the city of Bremerton are provided based on densities of residential development.

Master Plan, Naval Station (NAVSTA), Puget Sound, Everett, Washington (1986). This plan provides comprehensive guidance and a framework for long-term land use planning at NAVSTA Everett.

City *of Everett Shoreline Management Plan.* Guidelines for land use on the Everett shoreline are provided in this overall management plan.

Master Plan, Pearl Harbor Naval Complex, Pearl Harbor, Hawaii (1992). This plan provides comprehensive guidance and a framework for long-term land use planning at Pearl Harbor Naval Complex.

Natural Resource Management Plan, Pearl Harbor Naval Complex, Pearl Harbor, Hawaii (1989). This plan focuses on the responsible use of natural resources at the Pearl Harbor Naval Complex and makes overall recommendations for land use at the site.

WATER QUALITY

Navy policy and requirements for controlling ship d&charges to the environment are presently contained in OPNAVTNST 5090.1B. These requirements are applicable to all home port sites assessed in this EIS (NASNI, PSNS, NAVSTA Everett, and PHNSY). These requirements, along with local instructions at each alternative site, ensure that discharges as a result of the operation of Naval vessels are in compliance with the Clean Water Act and present no significant impact to the environment.

Also, the National Defense Authorization Act of 1996 amended Section 213 of the Federal Water Pollution Control Act (or "Clean Water Act") to require that the Secretary of Defense and the Administrator of the Environmental Protection Agency (EPA) jointly develop Uniform National Discharge Standards (UNDS) for discharges incidental to the normal operation of vessels of the Armed Forces. The intent of this act is to establish a consistent set of effluent standards that improves environmental protection while enhancing the operational flexibility of Armed Forces vessels that visit various ports as part of their missions. The Navy and EPA are currently working together and in consultation with states and other stakeholders in a three phase process to (1) determine those discharges that have the potential to cause environmental effects and that can be practically controlled with a marine pollution control device (MPCD); (2) set performance standards for the MPCDs; and (3) publish regulations governing the MPCD design, installation, and use. Completion of the UNDS regulatory development process is anticipated in late 2001. All vessels of the armed forces, including CVNs at NASNI, PSNS, PHNSY, NAVSTA Everett, will operate in compliance with the requirements on the effective dates set forth in the final rules.

Federal

Rivers and Harbors Appropriation Act of 1899, 33 U.S.C.A. §§ 401 to 454 (West 1987 ***& Supp. 1 997).*** Section 10 of the Rivers and Harbors Act limits the discharge of fill into navigable waters of the United States.

Clean Water Act (CWA), 33 U.S.C.A. §§ 1251 to 1387 (1986 & Supp. 1997). The CWA is the major federal legislation concerning improvement of the nation's water resources. It provides for development of municipal and industrial wastewater treatment standards and a permitting system to control wastewater discharges to surface waters. State operation of the program is encouraged. The CWA is the primary federal statute governing the discharge of dredged and/or fill material into U.S. waters. Relevant sections include the following:

- Section 208 requires that states develop programs to identify and control nonpoint sources of pollution, including runoff.
- Section 230.8 gives authority to COE and EPA to specify, in advance, sites that are either suitable or unsuitable for the discharge of dredged or fill material within U.S. waters.
- Section 303 requires states to establish and enforce water quality standards to protect and enhance beneficial uses of water for such purposes as recreation and fisheries.
- Section 304(a)(l) requires the administrator of the EPA to publish criteria for water quality that reflect the latest scientific knowledge regarding the effects of pollutants in any body of water.
- Section 313(a) requires that federal **agencies observe state and local** water quality regulations.
- Section 401 of the CWA applies to dredging activities and requires certification that the permitted project complies **with State Water Quality Standards for actions within state waters. Under Section 401, states must establish Water Quality Standards for waters in the territorial sea. Dredging may not cause the concentrations of chemicals in the water** column to exceed state standards. To **receive** state certification, **a** permit applicant must **demonstrate that these standards will not be exceeded.**
- Section 401(a)(l) requires any applicant for a **federal permit (i.e.,** Section 404) to provide certification from the state in which the discharge originates that such discharge will comply with applicable water quality provisions (i.e., Section 303).
- Section 402 requires the EPA Administrator to develop the National Pollutant Discharge Elimination System (NPDES) to issue permits for pollutant discharges to waters of the United States.
- Section 404 of the CWA establishes a program to regulate the discharge of dredge and fill material into navigable waters of the United States. The CWA and MPRSA overlap for discharges to the territorial sea. The CWA supersedes the Marine Protection,

Research, and Sanctuaries Act (MPRSA) if dredged material is dumped in the ocean for beach restoration or some other beneficial use. The MPRSA supersedes the CWA if dredged material is transported and disposed of in the territorial sea.

- Section 404 (b)(l) Guidelines are the substantive criteria used in evaluating discharges of dredged or fill material- under Section 404.

Safe Drinking Water Act (SDWA) *of 1974, 42 U.S.C.A. §§ 300f to 300j-26* (West *1991 & Supp. 1997).* This Act establishes the amount of concentrated contaminants allowable in public drinking water. The SDWA also reviews federal agencies that maintain public water supply or contribute to groundwater contamination, following all applicable requirements issued by the state.

Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972 (the Ocean Dumping Act), 33 U.S.C.A. §§ 1401 to 1445 (West 2996 & Supp. 1997). This act establishes a framework for the control of dumping material in the territorial sea and seaward and includes specific criteria and conditions for permissible dumping. The MPRSA is the primary federal environmental statue governing the discharge of dredged material in the ocean.

Section 102 of the Act **authorizes** the EPA to promulgate environmental criteria for evaluation of all dumping permit actions, to retain review authority over COE MPRSA 103 permits, and to designate ocean disposal sites for dredged material disposal. The EPA's regulations for ocean disposal are published at 40 C.F.R. Parts 220-229 (1997). Under the authority of Section 103 of the MPRSA, the COE may issue ocean dumping permits for dredged material if the EPA concurs with the decision. If the EPA does **not agree with a** COE permit decision, a waiver process under Section 103 allows further action to be taken. The permitting regulations promulgated by the COE, under MPRSA, appear in 33 C.F.R. Parts 320-330 (1997) and 335-338. Based on an evaluation of compliance with the regulatory criteria of 40 CFR 227, both the EPA and COE may prohibit or restrict disposal of material that does not meet the criteria. The EPA and COE also may determine that ocean disposal is inappropriate because of Ocean Dredged Material Disposal Site (ODMDS) management restrictions or because options for beneficial use(s) exist(s). Site management guidance is provided in 40 CFR 228.7-228.11.

Oil Pollution Act of 2990 (OPA 90), 33 U.S.C.A. §§ 2702 to 2761 (West Supp. 2997). This **Act** requires owners and operators of facilities that could cause substantial harm to the environment to prepare and submit plans for responding to worst-case discharges of oil and hazardous substances.

State

Porter-Cologne Water Quality Control Act, Cal. Water Code §§ 13000 to 13953.4 (Deering 1977 & Supp. 1998) and its implementing regulations in Cal. Code Regs. tit. 23 (1997). This **Act** mandates that the waters of the state shall be protected, such that activities that may affect waters of the state shall be regulated to attain the highest quality.

California Environmental Quality Act, Cal. Pub. Res. Code §§ 21000 to 21177 (Deering 1996 & Supp. 1998). The Department of the Navy interprets the California Environmental Quality Act

(CEQA) as being inapplicable to federal projects. Nevertheless, pursuant to an agreement with the Regional Water Quality Control Board, San Diego Region (RWQCB), this EIS and the accompanying public participation process are intended to cover the requirements of *Cal.* Code Reg. tit. 14, @15087(a), 15221, and 15225 (1997). Accordingly, the RWQCB may decide to use this EIS in place of an EIR without recirculation of the federal document (EIS) for public review. The California Environmental Quality Act (CEQA) contains requirements similar to NEPA and requires the preparation of an Environmental Impact Report (EIR) prior to implementation of applicable projects. CEQA requires significant impacts to be mitigated to a level of insignificance or the maximum extent feasible. The state or local lead agency is responsible for CEQA compliance.

Coastal Waters Protection Act of 1971, Wash. Rev. Code Ann. §§ 90.48.010 to 90.48.906 (West 1992 *& Supp.* 1998) This act aids in prevention and control of waters within the state. It assists in maintenance of purity of all state waters for public enjoyment and the protection of wildlife, birds, game, fish, and other aquatic life.

Puget Sound Dredge Disposal Analysis (Not Codified). The PSDDA site environmental monitoring plan is designed to verify that no unacceptable adverse effects have occurred within or beyond the disposal site as a result of dredged material disposal and to ensure that the dredged material disposed at the site remains within the disposal site boundary. The environmental monitoring forms the basis for the annual review of the need for changes in the evaluation procedures and site management plans. A full monitoring survey ascertains that the dredged material was deposited on site; determines if the dredged material is producing chemical and/or biological conditions on site beyond "minor adverse effects"; and determines if the dredged material is causing adverse biological impacts beyond the site boundaries.

Water Pollution, Haw. Rev. Stat. §§ 342D-1 to 342D-70 (1993 & Supp. 1996) and its implementing regulations in Haw. Admin. Rules tit. 11, chapters 54, 55 (1992). This Act sets guidelines for **maintaining clean water in** Hawaii, and it sets standards for maximum allowable levels of certain metals and other non-organic substances in water.

AIR QUALITY

Federal

Clean Air Act (CAA), 42 U.S.C.A. §§ 7401 to 7671q (West 1995 *& Supp.* 1997). This Act, with its subsequent amendments of **1977, 1990, and 1993, sets forth National Ambient Air Quality** Standards (NAAQS) for ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter less than 10 microns in diameter (PM_{10}), and lead (Pb), which must not be exceeded more than once per year. The Act allows individual states to adopt pollutant standards that are equal to or more stringent than the NAAQS. The Act also requires federal actions to conform with the goals **of the** applicable **State** Implementation Plan (SIP). Section 176(c) of the Act outlines the procedures to make a conformity determination for federal actions. **This Act also regulates hazardous air pollutants under the EPA regulatory program for** National Emission Standards for Hazardous Air Pollutants (NESHAPS), including radionuclides and asbestos.

Federal General Conformity Rule, Clean Air Act § 176(c), 42 U.S.C.A. § 7506(c) (West 1995 *& Supp. 1997) and its implementing regulations in 40 C.F.R. Part* 93 (1997) This rule implements standards set by the clean air act for air quality.

State

Air Resources, Cal Health & Safety Code §§ 39000 to 44474 (Deering 1986 & Supp. 1998)

Washington Clean Air Act, Wash. *Rev. Code Ann. §§ 70.94.011 to 70.94.990* (West 2992 *&* Supp. *1998) and its implementing regulations in* Wash. *Admin. Code ch. 173-400 (1997 & Supp. 1998).* These regulations provide an outline of state air regulations, which are at least as restrictive as NAAQS. However, the responsibility of regulating most air pollution sources is given to local agencies.

Hawaii Air Pollution Control Act, Haw. Rev. Stat. §§ 342B-1 to 342B-63 (1993 & Supp. 1996) and its implementing regulations in Haw. Admin. Rules tit. 11, chs. 59, 60. These regulations provide an outline of state air regulations for the monitoring of air pollution.

Local

San Diego County Air Pollution Control District (SDCAPCD) Rules and Regulations (1998). The SDCAPCD is responsible for achieving and maintaining the state and national ambient air quality standards within the San Diego Air Basin (SDAB) (San Diego County). This responsibility is performed by the regulation of stationary sources of air pollution. The *SDCAPCD Rules and Regulations* establish emission limitations and control requirements for stationary sources, based upon their source type and magnitude of emissions. Pursuant to Rule 10, persons that propose to operate a new or modified emission source must first obtain an Authority to Construct (ATC) from the SDCAPCD prior to construction. Final approval to operate is provided in the form of a Permit to Operate (PTO). SDCAPCD Rule 20, Standards for Granting Permits, and other New Source Review Rules (20.1 through 20.8), outline thresholds that trigger (1) the application of best available control technologies (BACT), (2) dispersion modeling analyses, and (3) emission offsets, as part of the ATC/PTO process. SDCAPCD Rule 1200, Toxic Air Contaminants • New Source Review, also states that any stationary source that requires an ATC/PTO and emits toxic air contaminants (TACs) must evaluate the potential health risks from these TACs as part of the permit process. Preliminary emission estimates show that the operation of the project dredging equipment would require an ATC/PTO.

2994 O_3 SIP *Revision for the San Diego Air Basin,* is a comprehensive plan to bring the SDAB into compliance with the national O_3 standard by the 1999 mandate for serious O_3 nonattainment areas. The 2994 SIP demonstrates attainment of the O_3 standard with on- and off-road motor vehicle emission controls proposed by the ARB and existing stationary source emission controls currently adopted by the SDCAPCD. The EPA approved this plan in January 1997. However, the SDAB recorded nine exceedances of the national O_3 standard in 1998, although the transport of O_3 precursor emissions from the Los Angeles metropolitan area contributed to seven of the exceedance days. The 1990 CAA allows for two one-year extensions beyond the final compliance date for serious O_3 areas (through 2001). If the SDAB experiences more than one exceedance of the national O_3 standard in 1999, the SDCAPCD will have to develop a new O_3 SIP by May 2001, which outlines how additional emission control measures would bring the region into attainment of this standard. **If the exceedances** are due to mainly from local emissions within the SDAB, the region would also be downgraded to a severe O_3 nonattainment rating. If the exceedances occur mainly from emissions transported into the region, the SIP would not have to proposes as many measures designed to reduce emissions within the SDAB. Regardless, the SDCAPCD has to develop a SIP by July 2003, which demonstrates how the SDAB will comply with the national eight-hour standard for O_3.

1998 ***Triennial*** Regional ***Air Quality Strategy (RAQS) Revision*** is the plan to bring the SDAB into compliance with the CAAQS. This plan includes all feasible control measures that can be implemented for the reduction of O_3 precursor emissions. To be consistent with the *RAQS*, a project must conform to the emission growth factors outlined in this plan. Control measures for stationary sources proposed in the *RAQS* and adopted by the SDCAPCD are incorporated into ***the Rule and Regulations, County of San Diego APCD. Since the CAAQS are*** more restrictive than the NAAQS, emission reductions beyond what would be **required** to show attainment for the NAAQS will be needed. Consequently, the focus of **attainment** planning in California has shifted from the federal to state requirements.

Puget Sound Air Pollution Control Agency Rules and Regulations (1997). These regulations were established by the PSAPCA, which regulates stationary sources of air pollution in Kitsap, Pierce, King, and Snohomish counties. Included in these regulations is requirement to obtain an approved Notice to Construct and Application for Approval from the PSAPCA prior to construction. In addition, the PSAPCA developed maintenance plans to outline methods of documentation and continuance of attainment of the NAAQS for O_3 and CO in the region through 2010. To accomplish the goal of attaining O_3, the PSAPCA will (1) maintain VOC and NO_x control measures **outlined in the existing O_3 SIP that in the past have been used to attain** the O_3 standard and (2) periodically review assumptions and control measures identified in the ***03 Maintenance Plan.***

Hawaii Air Pollution Control District Rules and Regulations (1997). The HAPCD is responsible for achieving and maintaining the state and federal air quality standards for Hawaii.

BIOLOGICAL RESOURCES

Federal

Endangered Species Act of 1973, 16 U.S.C.A. §§ 1531 to 1534 (West ***1985 & Supp. 1997). The*** Endangered Species Act protects threatened and endangered species by prohibiting federal actions that would jeopardize the continued existence of such species or by **minimizing** actions that would result in the destruction or adverse modification of any critical habitat of such species. Section 7 of the Act requires that consultation regarding protection of such species be conducted with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS) prior to project implementation. During the project design process, the USFWS and the NMFS evaluate potential impacts of ocean disposal on threatened or endangered species. These agencies are asked to certify or concur with the sponsoring agency's findings that the proposed activity will not adversely affect endangered or threatened species.

Exec. Order 22,990 (Protection of Wetlands), 42 *Fed.* Reg. 26,962 (1977). The key requirement of this executive order is determinin g whether a practicable alternative to locating an action in wetlands exists. If there is no practicable alternative, the action must include all practical measures to minimize harm to the wetlands.

Fish and Wildlife Coordination Act, 16 U.S.C.A. §§ 661 to 668ee (West 1985 *& Supp. 1997).* The Fish and Wildlife Coordination Act requires that any federal agency proposing to control or modify any body of water must first consult with the USFWS or the NMFS.

Conservation Programs on Government Lands (Sikes Act) §§ 670a to 6700 (West 1985 & Supp. 1997). The Sikes Act requires each military installation to manage natural resources to provide for multipurpose uses and to provide public access appropriate for those uses, unless access is inconsistent with the military mission. It also requires each military department to ensure that professional services are provided that are necessary for management of fish and wildlife resources on each installation (per tripartite cooperative plan agreed to by USFWS and state wildlife agencies), to provide their personnel with professional training in fish and wildlife management, and to give contracting work priority with federal and state agencies having responsibility for conservation or management of fish and wildlife.

Marine Mammal Protection Act, 16 U.S.C.A. §§ 1361 to 1421h (West 1985 *& Supp.* 1997). The Marine Mammal Protection Act protects marine mammals and establishes a marine mammal commission to regulate such protection.

Fish and Wildlife Conservation Act of 1972 (Nongame Act), 16 U.S.C. §§ 2901 to 2912 *(West 1985 & Supp. 1997).* The Nongame Act has authorized grants for development and implementation of comprehensive state plans for nongame species of fish and wildlife. The Act was later amended to require the USFWS to identify lands, located in the United States and other Western Hemisphere countries, of which protection, management, or acquisition would foster the conservation of migratory nongame birds.

Exec. Order 13,089 *(Coral Reef Protection),* 63 *Fed.* Reg. No. 115 (1998). In order to protect coral reef habitats, all Federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems. Federal agencies whose actions affect U.S. coral reef ecosystems, shall also, provide for implementation of measures needed to research, monitor, manage, and restore affected ecosystems, including, measures reducing impacts from pollution, sedimentation, and fishing. To assist in the implementation of this Executive Order, a task force shall be developed to provide support for: coral reef mapping and monitoring, research, conservation, mitigation, and restoration, and facilitation of international cooperation.

Exec. Order 13,112 (Invasive Species), 64 Fed. Reg. No. 25 (1999). This Executive Order was established to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable, (1) identify such actions; (2) use relevant Programs and authorities to prevent, identify, and control the introduction of invasive species; (3) not authorize, fund, or carry out **actions** that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, the agency has determined that the benefits clearly outweigh the potential harm caused by invasive species. The Order also establishes an Invasive Species Council to provide national leadership regarding invasive species and prepare and issue a National Invasive Species Management Plan, which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan.

State

California Endangered Species Act, Cal. Fish & Game Code §§ 2050 to 2116 (Deering 1989 & Supp. 1998). The CESA provides for the recognition and protection of rare, **threatened,** and endangered species of plants and animals. The Act requires state agencies to consult with the CDFG to ensure that state-authorized or funded actions do not jeopardize the continued existence of a listed species. The Act prohibits the taking (collection, killing, or injury, whether intentional or accidental) of listed species without authorization from the CDFG. CDFG may authorize the taking of a listed species through a Memorandum of Understanding that establishes the extent of take permitted by CDFG and sets forth the required mitigation. State-listed species are addressed in this document.

Fisheries Code of the State of Washington, Wash. Rev. Code Ann. §§ 75.08.010 to 75.08.530 (West 2994 & Supp. 1998) and its implementing regulations in Hydraulic Code Rules, Wash. Admin. Code ch. 220-120 (1997 & Supp. 1998) This code aids in the preservation of fisheries within the state of Washington, ensuring they are kept free from harmful pollutants and barriers to reproduction.

Conservation of Aquatic Life, Wildlife, and Land Plants, Haw. Rev. Stat. §§ 195D-1 to 195D-10 (1993 & Supp. 1996) This statute works in conjunction with federal laws to maintain the diversity of wildlife in Hawaii through protection of native plants and animals.

CULTURAL RESOURCES

Federal

National Historic Presentation Act, 16 U.S.C.A. §§ 470 to 470x-6 (West 1985 & Supp. 1997). **Cultural** resources (historic, prehistoric, archaeological, and architectural sites or properties) are protected under the NHPA, as amended Executive Order 11593: Protection and Enhancement of the Cultural Environment (36 CFR 8921), and the Archaeological and Historic Presentation Act of 1974 (16 U.S.C. 469 et seq.), which involves the threat of irreparable loss or destruction of significant scientific, prehistoric, historical, or archaeological data by federal construction projects. Section 106 of the NHPA requires **a** federal agency to take into account the potential effect of **a** proposed action on properties listed **on** or eligible for listing on the National Register of Historic Places (National Register). Section 110 of NHPA requires the adaptive reuse of historic properties to the maximum extent practicable. The State Historic Preservation Officer and the Federal Advisory Council on Historic Preservation (ACHP) are responsible for implementing this Act for federal projects.

The NHPA established the ACHP to comment on federally licensed, funded, or executed undertakings affecting National Register properties. Regulations of the ACHP (36 CFR 800) outline the procedures used by a federal agency to meet the requirements of Section 106 of the NHPA.

Archaeological Resources Protection Act (ARPA) of 1979, 1 6 U.S.C.A. §§ 470aa to 470mm (West 1985 & Supp. 1997). This Act clarifies and defines archaeological resources; prohibits the removal, sale, receipt, and interstate transport of illegally obtained archaeological resources from public or Indian lands; provides substantial criminal and civil penalties for those who violate the terms of the act; authorizes confidentiality of site-location information; and authorizes permit procedures to enable qualified individuals to study archaeological resources on public and Indian lands.

Archaeological Resources Protection Act (ARPA) of 1979, Final Uniform Regulations, 32 C.F.R. Part 229 (1997). Promulgated by the Departments of the Interior, Agriculture, and Defense and the Tennessee Valley Authority, this Act establishes uniform procedures for implementing provisions of the ARPA of 1979. These regulations enable federal land managers to protect archaeological resources on public and Indian lands.

Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C.A. §§ 3001 to 3013 (West *Supp. 1997).* This Act assigns ownership to Native Americans of human burials, and associated grave goods that are excavated or discovered on federal or tribal lands; requires federally sponsored museums to conduct inventories of their collections; and requires a 30-day delay in project work when human remains are discovered on federal lands.

State

Historic Preservation, Haw. Rev. *Stat. ch. 6E (1993 & Supp.* 1996). This law applies to anyone proposing construction, alteration, or improvement of any nature on a site listed in the Hawaii Register of Historic Places. The applicant must file a notice of his intention to work on the site with the State Department of Land and Natural resources 90 days in advance of the proposed start date, making clear the nature of the proposed construction and the precise location of the historic site. Following the 90-day notification period, the department must respond to the request for construction with one of the following three answers:

1. The action may proceed unimpeded.
2. Undertake or permit the investigation, recording, preservation, and salvage of any historical information deemed necessary to preserve Hawaiian history.
3. Condemnation proceedings may be initiated top take the property upon just compensation of the owner.

PUBLIC HEALTH AND SAFETY

Federal

Exec. Order 12,088 (Federal Compliance with Pollution Control Standards), 43 Fed. Reg. 47,707 (1978). This order directs that federal agencies consult with state and local agencies concerning the best techniques and methods available for the prevention, control, and abatement of environmental pollution. A federal agency must also comply with applicable pollution control standards concerning air pollution, water pollution, hazardous materials, and hazardous substances.

Exec. Order 12,856 (Federal Compliance with Right-to Know Laws and Pollution Prevention Requirements), 58 ***Fed.*** Reg. 41,981 ***(1993).*** This Executive Order provides enforcement of the Federal Right-to-Know Laws that encourage and support emergency planning for responding to chemical accidents and provide local governments and the public with information about possible chemical hazards in their communities and the Pollution Prevention Act of 1990 that encourages a national policy of point-source reduction of pollution as well as recycling of pollution that cannot be prevented or recycled.

Exec. Order 12,898 (Environmental Justice), 59 Fed. Reg. 7,629 (1994). Executive Order 12898 was issued by President Clinton on February **11, 1994,** and urged each federal agency to achieve environmental justice by addressing "disproportionately high and adverse human health and environmental effects. . . on minority and low-income populations." Each federal agency has 12 months from the date of issuance to finalize a strategy for promoting enforcement of **all** health and environmental statutes in areas with minority and low-income populations, improving data collection, identifying differential patterns of natural resource consumption, and ensuring greater public participation.

Exec. Order 13,045 (Environmental Justice for Children, Protection from Environmental Health Risks and Safety Risks), 62 ***Fed.*** Reg. 29883 ***(1997).*** This executive order was prompted by the recognition that children, still undergoing physiological growth and development, are more sensitive to adverse environmental health and safety risks than adults. Under this order, the federal agency must ensure that its policies, programs, activities, and standards address disproportionate environmental health or safety risks to children that result from the project or substances that the child is likely to come into contact with or ingest. These impacts include increases in noise and air pollutant levels.

Resource Consemation and Recovery Act (RCRA) of 1976, 42 U.S.C.A. §§ 6901 to 6992k (West 1995 & Supp. ***1997). This law was the*** first step in regulating the potential health and environmental problems associated with hazardous waste disposal. RCRA and the regulations developed by the EPA to implement its provisions provide the general framework of the national hazardous waste management system, including the determination of whether hazardous wastes are being generated, techniques for tracking wastes to eventual disposal, and the design and permitting of hazardous waste facilities. Hazardous and Solid Waste Amendments (HSWA) addressed regulatory gaps in the RCRA program in the area of highly toxic wastes. For example, these include regulation of carcinogens, listing and delisting of hazardous wastes, permitting for hazardous waste facilities, underground storage tank (UST) management, and the elimination of land disposal of hazardous wastes.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, 42 U.S.C.A. §§ 9601 to 9675 (West 1995 & Supp. 2997). CERCLA, also known as Superfund, ensures that a source of funds is available to clean up abandoned hazardous waste dumps, compensate victims, address releases of hazardous materials, and establish liability standards for responsible parties. The DoD, however, is not covered by trust funds. The Act also requires creation of a National Priorities List (NPL), which sets forth the sites considered to have the highest priority for clean-up under Superfund. Superfund Amendments and Reauthorization Act (SARA) was enacted in 1986 to increase the Superfund to $8.5 billion, modify contaminated site clean-up criteria scheduling, and revise settlement procedures. It also provides a fund for leaking UST cleanups and a broad new emergency planning and community right-to-know program. SARA establishes directives for selecting permanent remedies, complying with state requirements by federal agencies, and establishing the role of the state in the clean-up process. The Act extended CERCLA to DoD.

Defense Environmental Restoration Program (DERP), 10 U.S.C.A. §§ 2701 to 2708 (West Supp. 1997). DERP is the DoD hazardous materials clean-up program. DERP was established under SARA. DERP follows the same basic procedures as CERCLA, including the same regulatory oversight. The goals of the program are the identification, investigation, remediation, and clean up of contamination from hazardous substances, pollutants, and contaminants. The funding for DERP is independent of Superfund. The IRP, which is part of DERP has been implemented by the Navy for the purpose of assessing and controlling migration of environmental contamination that may have resulted from past operations and disposal practices on Navy facilities. It is funded by the Defense Environmental Restoration Account, which is an annual appropriation to deal primarily with CERCLA-type response actions.

Toxic Substances Control Act (TSCA), 15 U.S.C.A. § 2601 to 2692 (West *1998).* TSCA provides authority to test and regulate chemicals to protect human health. Substances regulated under TSCA include asbestos and PCBs. All federal facilities are required to abide by its regulations.

Chief of Naval Operations, Environmental and Natural Resources Program Manual, Navy Occupational Safety and Health (NAVOSH) Program Instructions (OPNAVINST) 3120.32C, 5100.19c, 5100.25A & Appendix A7-C. The NAVOSH Program complies with all applicable Occupational Safety and Health Administration (OSHA) regulations to ensure safe and healthful conditions in the workplace. The NAVOSH program is applicable to all Navy civilian and military personnel and operations ashore and afloat. This program is implemented at each Navy facility and includes compliance with applicable standards; annual inspection of workplaces by qualified inspectors; prompt abatement of identified hazards; procedures for all personnel to report suspected hazards; appropriate training for all safety and health officials, supervisory personnel, and employees; procedures to review, in advance of construction/ procurement, the design of facilities, systems, and subsystems to insure that hazards are eliminated or controlled through the life cycle; mishap investigation with follow-up corrective action; a medical surveillance program to monitor employees exposed to potential hazards, to identify exposure changes to groups of employees, and to identify previously unrecognized sources of exposure. All work involving hazardous materials is accomplished by specially trained people using the appropriate personal protective equipment, in accordance with the applicable occupational safety and health requirements.

Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, 42 U.S.C.A. §§ 11001 to 11050 (West 2995 & Supp. 1997). This Act was developed (1) to encourage and support emergency planning for responding to chemical accidents and (2) to provide local governments and the public with information about possible chemical hazards in their communities. Local Emergency Planning Committees (LEPCs) have been formed as required by the law. LEPCs receive information, analyze hazards, and develop plans to prepare for and respond to chemical emergencies. To assist in this process, Material Safety Data Sheets and chemical inventories are provided by industries for the LEPCs, as well as the State Emergency Response Commission and the local fire department.

Federal Insecticide, Fungicide, and Rodenticide Act, as amended, 7 USC §§ 135 et seq and 7 USC §§ 136 et seq. This act regulates a number of insecticides, fungicides and rodenticides to ensure their safe handling and application.

State

Uniform Fire Code (1997) This statute assists in the regulation of preventing and removing of fire hazards. It sets standards to protect life and property from the effects of fires and explosions caused by hazardous conditions in structures or on premises. It also establishes guidelines for appropriate construction materials which would reduce fire hazards.

Underground Storage of Hazardous Substances, Cal. Health & Safety Code §§ 25280 to 25299.7 (Deering 1988 & Supp. 1998) To help prevent future contamination due to leaking from underground storage tanks, this code sets state standards.

Underground Storage Tanks, Wash. Rev. Code Ann. §§ 90.76.005 to 90.76.903 (West 1992 & Supp. 1998) This statute works in conjunction with federal laws to regulate the safety of underground storage tanks (UST). UST must meet certain criteria which ensure that the constituents of the tank do not enter the surrounding soil or water. These regulations prescribe standards applicable to the closure and reuse of UST facilities. They also define procedures for reporting UST leaks and maintaining UST inventory data.

Underground Storage Tanks, Haw. Rep. Stat. §§ 342L-1 to 342L-53 (1993 & Supp. 1996) This statute works in conjunction with federal laws to regulate the safety of underground storage tanks (UST). UST must meet certain criteria which ensure that the constituents of the tank do not enter the surrounding soil or water. These regulations prescribe standards applicable to the closure and reuse of UST facilities. They also define procedures for reporting UST leaks and maintaining UST inventory data.

Hazardous Waste Control, Cal. Health & Safety Code §§ 25100 to 25249, 25250 to 25250.25 (Deering 1988 & Supp. 1998) This act works in conjunction with federal guidelines to ensure the proper storage and disposal of hazardous wastes. Included in the act are measures to minimize impacts and protect health and safety of the community and those handling the waste..

Hazardous Waste Management Act, Wash. Rev. Code Ann. §§ 70.105.005 to 70.105.900 (West 1992 & Supp. 1998) This act works in conjunction with federal guidelines to ensure the proper storage and disposal of hazardous wastes. Included in the act are measures to minimize impacts and protect health and safety of the community and those handling the waste.

Hazardous Waste, Haw. Rev. Stat. 342J-1 to 342J-56 (1993 & Supp. 1996) This act works in conjunction with federal guidelines to ensure the proper storage and disposal of hazardous wastes. Included in the act are measures to minimize impacts and protect health and safety of the community and those handling the waste.

Carpenter-Presley-Tanner Hazardous Substance Account Act, Cal. Health & Safety Code §§ 25300 to 25395.25 *(Deering 1988 & Supp. 1998)* This act appropriates funds to the Department of Toxic Substances Control for emergencies and other procedures relating to toxic substance control. The act authorizes a person to apply to the State Board of Control for compensation of a loss caused by the release of a hazardous substance, and provides that any person who knowingly gives, or causes to be given, any false information as part of a claim for compensation is guilty of a misdemeanor.

Model Toxics Control Act, Wash. Rev. Code Ann. §§ 70.105D.010 to 70.105D.921 (West 2992 *& Supp. 1998)* This act provides for the cleanup of Washington's hazardous waste sites, planning and management of hazardous waste, protecting water and environment from hazardous waste, and other activities. The law imposes the hazardous substance tax on the possession of certain hazardous substances within the state to fund the law. The department of Ecology administers the act through regulation and monitoring of dangerous materials, overseeing hazardous waste disposal and cleanup, and provision of grants to local governments for cleanup activities.

Environmental Response Law, Haw. Rev. Stat. §§ 128D-1 to 128D-23 (1993 & Supp. 1996) This *law* implements regulations for response to environmental hazardous such as toxic substance spills.

NOISE STANDARDS

Federal

Noise Control Act of 1972 and Quiet Communities Act of 2978, 42 *U.S.C.A. §§ 4901 to 4918 (West* 2995 *& Supp. 1997).* This Act identifies noise as a key environmental issue and requires its due consideration within the permit process for new projects. The Quiet Communities Act of 1978 amended the Noise Control Act of 1972 to identify noise as a *key* environmental issue and to require its due consideration within the permit process for new projects.

State

California Noise Control Act of 1973, Cal. Health & Safety Code §§ 46000 to 46080 (Deering 1997 & Supp. 1998) This act provides more specific measures than its federal counterpart to regulate the nose environment, particularly at off-site receptors.

Cal. Gov't Code *§ 65302(f) (noise element of general plans) (Deering* 1987 *& Supp.* 1998). This statute required preparation of a Local General Plan Noise Element.

Noise Control Act of 1974, Wash. Rev. Code Ann. §§ 70.107.010 to 70.107.910 **(West 1992** *& Supp. 1998)* This act provides more specific measures than its federal counterpart to regulate the nose environment, particularly at off-site receptors.

Noise Pollution, Haw. Rev. Stat. §§ 342F-1 to 342F-33 (1993 & Supp. 1996) and its implementing regulations in Haw. Admin. Rules ch. 46 (1996) This act provides more specific measures than its federal counterpart to regulate the nose environment, particularly at off-site receptors.

Community Noise Control, State of Hawaii Department of Health, Haw. Admin. Rules §46, 1996. These regulations set guidelines for maximum allowable noise levels from different sources during the day and night.

Local

Noise Elements of County and City General Plans. The Noise Element of the General Plan for each local jurisdiction contains standards for various types of land uses (i.e., residential commercial single-family, residential, multiunit residential). These Noise Elements are updated every 5 to 15 years. Many cities have also adopted noise ordinances to control local noise in their particular communities. Many Noise Elements extend the guidelines from the State Building Code (CCR Title 24, Part II) to apply to single-family residences.

UTILITIES

Federal

Exec.** Order 12902 (Energy **Efficiency** and Water **Conservation** at Federal Facilities), 59 Fed. Reg. No.* 47. *(March **8, 1994). This Executive Order provides enforcement for including the Energy Policy and Conservation Act, as amended by the Energy Policy Act of 1992. The order specifically calls for appropriate energy and water conservation maintenance and operating procedures in federal facilities; recommendations for the acquisition and installation of energy conservation measures, including solar and other renewable energy and water conservation measures; and a strategy to implement the recommendations.

APPENDIX B

SUMMARY OF EIS SCOPING ISSUES

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SUMMARY OF EIS SCOPING ISSUES

A Notice of Intent (NOI) was published in the *Federal Register* on 3 December 1996. Four scoping hearings were held, as follows: in Bremerton, Washington, on 3 February 1997; in Everett, Washington, on 4 February 1997; in Pearl City, Hawaii, on 6 February 1997; and in Coronado, California on 10 February 1997. A summary of issues identified at the scoping sessions and in letters received in responses to the NO1 follow.

CVN HOMEPORT FACILITIES
NAVAL AIR STATION NORTH ISLAND - CORONADO
SUMMARY OF EISSCOPING ISSUES

1. U.S. Environmental Protection Agency, Region IX (letter applies to all four sites)

   - Requests 3 copies of DEIS be sent to Region IX office, Attn: D.J. Farrel, Chief
   - EIS should include a full analysis of impacts related to dredging and sediment disposal, specifically impacts on: biological resources, geologic resources, air quality, hydrologic resources, water quality, and relevant treatment technologies
   - EIS should also address: aesthetics, cultural resources, health and safety, so&economics, environmental justice, and cumulative impacts
   - US EPA provides NEPA guidance concerning: range of alternatives; project parameters (time periods, study area, region of influence); purpose and need; cumulative effects; preferred alternative, environmentally preferable alternative; nearby residential areas (environmental justice); mitigation measures (avoid, minimize, rectify, and compensate); baseline conditions; and significance criteria
   - US EPA specifies requirements for the air quality analysis
   - US EPA specifies requirements for the land use, plans, and policies analysis
   - US EPA specifies requirements for wetlands, water quality, and section 404 analyses
   - US EPA specifies requirements for the biological resources analysis
   - US EPA specifies requirements for addressing waste and hazardous materials (health and safety analysis), including pollution prevention, energy conservation, waste minimization, and health impacts from fish consumption (subsistence fishing)
   - US EPA specifies requirements for the cultural resources analysis
   - US EPA specifies requirements for the noise analysis
   - US EPA's letter had an attached 17"x22" drawing of CVN Berthing Wharf (P-700A) (original sent to Andrew Lissner)

2. U.S. Department of the Interior, Fish and Wildlife Service (USFWS) (letter applies to all four sites)

   - USFW&S is particularly concerned about **impact on San Diego and environs, which** provide habitat for several listed bird species
   - Homeport ships may transport non-indigenous marine organisms into nearshore habitats **(water ballast in ships and seawater pipe systems)**
   - **USFWS specifies requirements for the biological resources analysis, including:**
     - **purpose and need for each alternative**

  - all alternatives considered to reduce impacts
  - impacts on marine habitat, fish, shorebirds, nesting herons and egrets, burrowing owls, and federally listed species
  - mitigation plan for entraining organisms during dredging
  - maps and quantification of habitats that may be affected
  - direct, indirect, and cumulative impacts of all facets of the project
  - detailed account, including status and distribution of federal candidate, proposed, and listed species and state-listed and locally sensitive species, including: California least tern, western snowy plover, and brown pelican)
  - Navy should initiate section 7 consultation/conferencing and include status report of consultation activities in the EIS
- EIS should consider enhancing nesting areas of the California least tern and snowy plover with non-contaminated sand from project dredging
- EIS should analyze impacts on water quality in San Diego Bay
- Include a risk assessment on transport of non-indigenous species to the homeport
- EIS should provide for upland disposal or treatment of contaminated dredged materials rather than nearshore or in-water disposal sites
- Give preference to modifying existing berths rather than dredging new berths
- Address increased demand for housing and services that may result in additional wetland losses
- The USFWS's initial point of contact for the San Diego Bay alternative is the Carlsbad Field Office, Martin Kenney, Wetlands Branch Chief at 619-431-9440

3. California Coastal Commission

- The proposed action is within or affects the coastal zone, and it is a federal agency activity. A consistency determination is, therefore, required.

4. Cal/EPA Department of Toxic Substances Control

- EIS should address: hazardous waste, mixed wastes, and radioactive wastes generated or transported by CVNs in port and at sea; land-based storage and/or treatment; cumulative hazardous waste impacts; mitigation measures
- EIS should address human and ecological health risks from releases of hazardous, mixed, and radioactive wastes
- EIS should include analysis of traffic accident potential involving transfer, storage, and treatment of hazardous or mixed wastes
- Clarify the relationship between the current project and the 1995 project for homeporting one CVN at NASNI (Cal/EPA states the 1995 EIS did not provide sufficient information to evaluate cumulative effects of proposed action and ongoing hazardous waste management operations)

5. City of Coronado, California

- City of Coronado requests a 75-day review period for the DEIS
- City of Coronado requests at least one DEIS public hearing in Coronado
- City of Coronado requests that the Coastal Commission hearing and all other agency reviews of the DEIS be held in the San Diego area
- City of Coronado requests a 45-day review period for the FEIS and an additional public hearing to comment on the FEIS before the ROD is signed
- City of Coronado questions the meaning and intent of several statements in the NO1 and requests clarification in the EIS
- Cumulative traffic impacts of first CVN, plus additional CVNs, and other construction projects
- Suitable dredged materials should be deposited on City beaches
- Cumulative impacts of first CVN plus additional CVNs (population, traffic, noise, pollution, housing, safety, infrastructure, and fiscal impacts)
- Cumulative impacts of relocation of E-2 aircraft to NASNI
- Describe transient operations and total berthing capacity of project
- Describe homeporting operations, including length of stays in port for each CVN
- Traffic impact analysis should include maintenance-related traffic, construction materials import/export traffic, and traffic mitigation measures (such as barging)
- Describe support facilities requirements, including modification of existing facilities, new construction, and dry dock requirements
- Fiscal analysis should include cost of barging all major materials, construction of a batch plant at North Island, cost of reducing additional trips through Coronado (outlying parking lots, buses, van pools), cost of new Third Street Gate, cost of housing, cost of utilities, and comparison of costs at other three homeport locations
- Utilities analysis should include sanitary/storm sewer (with 25-year capacity projection), gas, television/video, wireless communications, electrical, telephone, fiber optics, and water supply
- Aesthetics analysis should include impacts on view corridors on Alameda Boulevard, use of City property, and shoreline access
- Air quality and noise analyses should include construction and operation activities on a local and regional basis
- Impacts of additional housing demand
- Impacts on law enforcement services

- Discuss the Navy's financial commitment to traffic reduction (pre-tax rideshare incentives, federal funding of roadway construction, etc.)
- Air quality analysis should include tactical equipment/ground support equipment and cumulative impacts of first CVN and E-2 project
- Public safety analysis should include: safety hazards due to increased number of CVNs and an evaluation of existing nuclear incident response plans
- Shoreline erosion effects along First Street due to dredging

6. San Diego Audubon Society

- EIS should address impacts on endangered species and biodiversity due to:
  - population growth leading to increased housing and infrastructure
  - dredging and marine construction impacts on water quality and marine habitat
  - increased likelihood of chemical and radioactive spills
  - increased use of antifouling paint and underwater hull maintenance
  - increased opportunities for introduction of invasive marine species from foreign ports
- Mitigation measures should include:
  - replacement of "sprawling Navy housing with real estate efficient housing
  - reduce commuter miles by reassigning housing closer to base, providing buses and shuttles, and facilitating carpools
  - creation of replacement habitat elsewhere to offset any displaced habitat
  - consider stormwater treatment projects
  - periodic monitoring for invasive marine species

7. Environmental Health Coalition -- San Diego Military Toxics Campaign

- Project analyses should include first homeported CVN, plus additional homeported CVNs, plus visits by additional CVNs during training missions
- Alternatives should include homeporting at Long Beach and cancellation of CVN-76
- EIS should analyze impacts of all foreseeable future projects at NASNI, including all future nuclear repair work
- Nuclear refueling/defueling or construction of dry-docks at NASNI should be prohibited
- Navy should disclose: information in Appendix I of 1995 EIS; the document entitled "Local San Diego Navy Instruction for Nuclear Reactor and Radiological Accident Procedures for Naval Nuclear Propulsion Plants"; and Navy accident, incident, and violations records
- Environmental justice analysis should include: toxic emissions and exposures, traffic, security, construction, earthquakes [sic], and personnel loading

- EHC letter has several attachments:
  - "A Short History **of Naval Nuclear Accidents" prepared by** San **Diego Military** Toxics Campaign
  - "San Diego Bay Toxic Master Plan" - EHC, June 25, 1996
  - Court decision EHC vs. U.S. Navy, et al, June 21, 1996
  - Court decision EHC vs. U.S. Navy, et al, February 10, 1997

8. Sierra Club, San Diego Chapter

- **Address alternatives** to the Nuclear Propulsion Maintenance and Radioactive Waste Storage Facilities
- EIS should specify if the nuclear repair, processing, and radioactive and hazardous waste storage facilities would be used only for the homeported CVNs or if they would serve other operations as well
- Water quality analysis should address:
  - thermal pollution from each and all CVNs, including transient CVNs
  - ship sanitary and industrial wastewater discharge and treatment while in port (NASNI or civilian plant)
  - stormwater **and** wash water runoff from CVNs
  - sampling of areas to be dredged
  - control of turbidity during dredging
  - mitigation of sensitive habitats disturbed during dredging or disposal
  - pollution due to corrosion protection measures (anti-fouling paint and cathodic protection of metals)
- Air quality analysis should address:
  - traffic emissions
  - ambient levels in Coronado neighborhoods adjacent to NASNI access roads during rush hour traffic
  - construction emissions, including dredging and traffic
  - operational emissions, including support ships
  - measures to meet new NAQS
  - monitoring stations (location, costs, operational responsibility)
  - human health impacts
- Health and safety analysis should address:
  - procedures and processes used in CVN maintenance that could release hazardous materials, training and certification of personnel involved, and failure rates
  - oversight review of classified maintenance processes
  - reactor testing following repair and refurbishment
  - monitoring for airborne radioactive materials
  - contingency plans for evacuation in case of accidental radioactive release
  - hazardous materials emergency response

  - risk analysis for radioactive plume from fire in radiological support facility
  - health risk from hazardous material release from CVN maintenance facilities
  - background air quality levels
  - CVN reactor safety issues, including combined health risks for all CVNs

- Noise analysis should address noise impacts on human health, including vehicular, aircraft, and CVN support operations
- Security measures should address terrorist attack from all pathways (land, air, water)
- Utilities analyses should address impacts of increased electric, gas, and water needs
- Cumulative analysis should include all foreseeable future Navy and civilian port projects, including increased ship activities that may be facilitated by CVN dredging
- EIS should address: upgrade infrastructure to support Deep Draft Power Intensive ships (AOE's from PSNS); four E-2 squadrons from NAS Miramar; and additional fixed and rotary wing aircraft
- EIS should address any future Navy plans for dry dock, nuclear refueling, or major nuclear propulsion overhaul facilities in the San Diego area to service CVNs
- Traffic mitigation should include steps to increase vehicle occupancy rate
- If the project requires any upgrades to NAVSTA San Diego, a separate scoping meeting should be held

9. Bryn Anderson

- Opposes CVN homeporting in San Diego Bay for the following reasons:
  - dredging destroys natural habitat
  - risk of nuclear accident
  - radioactive waste storage
  - difficulty of urban evacuation in case of nuclear accident
  - impacts on marine life

10. Tom B. Arena

- Supports CVN homeporting at NASNI

11. Ms. Gloria Curran

- Describe possible toxic and radioactive spills and emissions
- Discuss trucking of radioactive and hazardous waste through Coronado
- Assess impact on air quality, including cancer risk
- Discuss noise mitigation
- Discuss traffic mitigation and funding

- Discuss housing for naval personnel and dependents
- Consider proximity to civilian population, especially schools
- Discuss Navy safety record for nuclear ships
- Present full disclosure of Navy plans for NASNI

12. Lindsay J. Barret

- EIS should discuss scoping and show that scoping issues are addressed in the EIS
- Traffic analysis should include number of additional commuters for each CVN
- Air quality analysis should include construction vehicles, all operational traffic, and additional aircraft
- Noise analysis should include traffic and aircraft noise

13. Earle Callahan

- Discuss plans to notify the public promptly in case of nuclear accident
- Concerned about NASNI becoming a major nuclear industrial center
- Desuibe security measures for nuclear facilities, including precautions against terrorist attack

14. Loris Cohen

- Opposes homeporting of CVNs at NASNI (radiation and cancer risk)

15. Millie and Gunder Creager

- Supports homeporting of CVNs at NASNI

16. Jimmy Cummins

- Supports homeporting of CVNs at NASNI

17. James R. Dawe

- ☠□♍□❍❍♏■♦⬧

18. Joseph Ditler

- Opposes homeporting of CVNs at NASNI (aircraft noise)

19. Richard W. Dittbenner, J.D.

- EIS should indicate the maximum number and type of nuclear vessels that the nuclear facilities could service at one time and the maximum number and type of vessels that could be in San Diego Bay at one time

- Safety analysis should address terrorism and emergency planning
- EIS should address procedures to notify surrounding communities of discharge of ionizing radiation and of any breaches of laws and regulations regarding nuclear materials
- EIS should address procedures to inform military personnel of exposure to ionizing radiation
- Traffic analysis should address impact on SR-54 travel times
- Housing analysis should address impacts on housing market
- Environmental justice analysis should address impact on Tijuana, Mexico

20. Beverly Dyer

- Concerned about aircraft noise, ship noise, toxic wastes, fire protection, pollution, air quality monitoring
- When was the Coronado City Council informed of possibility of additional CVNs?
- Concerned about dredging, hazardous materials, eel grass habitat, traffic, noise, and air pollution, water supply, wastewater disposal, seismicity, explosions, accidents, and inadequate emergency exit from Coronado

21. Marilyn G. Field

- EIS should address potential releases of radioactive liquids, steam, or primary coolant as a result of an earthquake, reactor accident, or sabotage
- EIS should assume that civilians living at base perimeter are at greatest risk
- EIS should discuss warning system and evacuation plan for Coronado
- EIS should explain Navy policy for notifying civilians in case of radiation release
- EIS should describe emergency assistance that Navy would provide to Coronado
- Traffic mitigation should include a new bridge or tunnel directly to NASNI
- EIS should discuss presence of earthquake faults and hazards of building on fill
- EIS should analyze potential accidents while loading weapons at NASNI
- Traffic analysis should address capacity of the bridge
- EIS should compare existing hazardous, toxic, radioactive background with project
- EIS should analyze potential reactor accident at low tide, considering: length of tow, width of channel, other traffic, proximity of populated areas to the tow route, and what happens after the vessel is towed to the sea

- EIS should address cost of cleanup for nuclear or hazardous accident and compare with costs at other sites

22. Clifton Foster, Capt. USN (Ret.)

- CVNs must have full access to the ocean; many NASNI facilities do not have this access
- To mitigate increased number of personnel at NASNI, relocate personnel that do not directly support CVNs (e.g., Ship Engine Overhaul Facility, Oily Wastewater Facility, Naval Air Reserve, Naval Legal Center, Defense Magacenter, Defense Printing Service, Defense Mapping Agency, Defense Reutilization and Marketing, Naval Audit Service, etc.)
- As a traffic mitigation measure, consider having freight carriers deliver all material to the Naval Supply Center in San Diego for consolidation of loads into fewer trucks (or barges) for delivery to NASNI

23. Betsy Gill

- Traffic analysis should include intersection analyses (Churchill/Orange/Ocean and others), accurate base population, dates of baseline studies, justification of baseline year and peak hour selections, worst-case scenarios, definition of study area, construction traffic, possible addition of fourth berth, analysis of capacity of bay bridge, closure of bridge (or lanes) for retrofit or accident or earthquake

24. Robert E. Hafey

- Current traffic problems caused by Navy must be addressed before a new project can be considered
- A nuclear waste storage facility cannot be constructed atop an earthquake fault

25. Harper R. Hathaway

- Concerned about additional traffic on Coronado city streets

26. Ruth M. Hames

- Opposed to CVN homeporting at NASNI

27. E. Miles Harvey

- EIS should address traffic impact along First Street in Coronado
- EIS should address noise impact due to increased traffic
- EIS should address dirt, debris, and air pollution due to increased traffic
- EIS should address feasibility and cost of all traffic mitigation measures

28. **Daniel B. Hunting, M.D.**

- Supports CVN homeporting at ☠✌💧☠🖐

29. Judy L. Johnson

- **Opposed to nuclear warships and nuclear weapons anywhere**
- Opposed to CVN homeporting at NASNI
- Concerned about traffic congestion, air pollution, and risk of nuclear accident

30. Sandor Kaup

- Concerned about a magnitude 6.8 to 7.0 earthquake along the Spanish Bight fault (damage to CVN pier and radioactive wastewater pipelines, adequacy of emergency response plans and disaster training, sufficient fail-safe devices at CVN piers)
- Concerned about increased waste storage and disposal requirements, air and water pollution from waste material handling
- Concerned about military and civilian health effects, traffic accidents, air pollution, noise, and evacuation plans
- Concerned about cumulative impacts of regional Navy and industrial operations

31. Stephanie S. Kaupp

- EIS should address combined impacts of first CVN and additional CVNs plus all planned military projects in the entire San Diego region for the next 10 years
- EIS should include all costs for this project over the next 10 years
- EIS should include all wastes generated at NASNI and all other sites associated with the project
- Requests a public hearing on the DEIS be held in Coronado with 10 minutes allowed for each speaker and notices in all Coronado papers and on San Diego television and radio stations with separate mailings to all impacted residents
- Requests a 90-day DEIS comment period with all data and other documentation available for public review

32. Joanne Marsh

- Supports Navy decisions regarding NASNI

33. Dixie L. McCarthy

- Concerned about evacuation plans in the event of a tsunami or an earthquake, traffic congestion in Coronado, and shortage of housing
- Concerned about increased noise and air pollution from aircraft operations

- Concerned about increased traffic in Coronado, current mitigation efforts (ferries and carpooling) have not worked .
- Concerned about increased drunk and disorderly behavior by sailors

34. Tom Miller

- EIS should identify distance between CVNs and civilian residences compared with typical nuclear power plant separation from residential areas
- EIS should identify prevailing winds relative to CVNs and civilian residences
- EIS should identify maximum carrier presence at NASNI over various time intervals and associated traffic and traffic noise
- EIS should identify cumulative average traffic and traffic noise
- EIS should identify after working hours ship maintenance noise sources and levels
- EIS should identify Navy point of contact for registering noise complaints
- EIS should identify sources and levels of federal funding for mitigation
- EIS should include quantified safety and quality of life impacts on public
- EIS should identify maximum hazardous waste storage requirements
- EIS should identify evacuation plans for NASNI and Coronado in the event of a nuclear accident and means to notify the City of an accident
- EIS should apply standard set of questions to each alternate homeport site and tabularize results for easy comparison

35. Paul A. Moore

- Nocomments

36. Mr. And Mrs. Arthur M. Osborne

- EIS should address traffic in Coronado as one of the most important issues (car pools and mass transit have not worked, traffic is getting worse, more NASNI commuters are driving alone, and trucks are getting bigger)

37. John M. Pettit, USN (Ret.)

- Supports CVN homeporting at NASM
- Traffic is a problem

38. Doris Ricks

- Supports CVN homeporting at NASNI *if* existing traffic problems are resolved first
- Letter contains detailed description of numerous existing traffic problems

- Recommends a new bridge or tunnel from downtown San Diego to NASNI

39. Joann 0. Riley

- EIS should address air contaminants from CVN waste dumps
- Trucks hauling waste, rock, and dirt should be covered

40. Galen Schelb (Realtor)

- The increasing traffic, noise, dirt, and risk from expansion at NASNI are affecting property values

41. Gerald and Eleanor Schwartz

- EIS should address impacts on air, water, soil, fish, birds
- EIS should address health hazards due to chemical or nuclear exposure
- EIS should address civilian warning system for any nuclear accident or problem
- EIS should address evacuation of civilian population at same time as military
- EIS should address construction of a new bridge or tunnel directly to NASNI

42. Patricia A. Shaffer

- EIS should address cumulative traffic impacts
- EIS should address traffic-related air quality impacts
- EIS should address increased traffic on the bridge and on Third and Fourth streets
- EIS should address traffic mitigation, including alternate access route to NASNI (new bridge or tunnel) and mass transit to NASNI with parking in San Diego
- EIS should address off base parking by NASNI commuters to avoid base regulations

43. Louis and Mary Semon

- Supports homeporting of CVNs at NASNI

44. Veronica E. Sissons

- Opposes homeporting of CVNs at NASNI
- Concerned about: release of contaminants from maintenance facilities in the event of an earthquake, increased risk of San Diego becoming a first strike target, increased contamination of local food fish, and accidental release of nuclear contaminants from CVNs and other nuclear-powered vessels

45. Michelle Stewart

- No comments (requests copies of any and all information about project plans)

46. James 0. Strickland

- Supports homeporting of CVNs at NASNI only if major traffic mitigation is funded by the federal government
- Traffic mitigation should include a new direct traffic link from San Diego to NASNI funded by the federal government

47. Dori E. Sullivan

- EIS should discuss transport of radioactive waste to storage and identify location of radioactive waste storage

48. Kent A. Thompson

- Supports homeporting of CVNs at NASNI
- EIS should address safety procedures for the nuclear propulsion units and associated machinery and the in place safety systems

49. Myra van den Akker

- Opposes homeporting of CVNs at NASNI
- Concerned about release of nuclear materials in the event of an earthquake
- Concerned about terrorism, especially regarding proximity of CVNs to the Coronado Ferry Landing
- Concerned about evacuation of Coronado in the event of an emergency, because the two surface roads that connect the city with the mainland cannot even adequately handle rush hour traffic

CVN HOMEPORT FACILITIES
PUGET SOUND NAVAL SHIPYARD - BREMERTON
SUMMARY OF EIS SCOPING ISSUES

1. Department of the Army, Corps of Engineers, Seattle District *(letter also applies to Everett)*
   - EIS should consider impacts on Native American fishing rights in Puget Sound, especially during maintenance and operation
2. US. Environmental Protection Agency, Region IX (letter applies to all four sites)
   - Requests 3 copies of DEIS be sent to Region IX office, Attn: D.J. Farrel, Chief
   - EIS should include a full analysis of impacts related to dredging and sediment disposal, specifically impacts on: biological resources, geologic resources, air quality, hydrologic resources, water quality, and relevant treatment technologies
   - EIS should also address: aesthetics, cultural resources, health and safety, socioeconomics, environmental justice, and cumulative impacts
   - US EPA provides NEPA guidance concerning: range of alternatives; project parameters (time periods, study area, region of influence); purpose and need; cumulative effects; preferred alternative, environmentally preferable alternative; nearby residential areas (environmental justice); mitigation measures (avoid, minimize, rectify, and compensate); baseline conditions; and significance criteria
   - US EPA specifies requirements for the air quality analysis
   - US EPA specifies requirements for the land use, plans, and policies analysis
   - US EPA specifies requirements for wetlands, water quality, and section 404 analyses
   - US EPA specifies requirements for the biological resources analysis
   - US EPA specifies requirements for addressing waste and hazardous materials (health and safety analysis), including pollution prevention, energy conservation, waste minimization, and health impacts from fish consumption (subsistence fishing)
   - US EPA specifies requirements for the cultural resources analysis
   - US EPA specifies requirements for the noise analysis
3. U.S. Department of the Interior, Fish and Wildlife Service (letter applies to all four sites)
   - Homeport ships may transport non-indigenous marine organisms into nearshore habitats (water ballast in ships and seawater pipe systems)
   - USFWS specifies requirements for the biological resources analysis, including:
     - purpose and need for each alternative
     - all alternatives considered to reduce impacts

  - impacts on marine habitat, fish, shorebirds, nesting herons and egrets, burrowing owls, and federally listed species
  - mitigation plan for entraining organisms during dredging
  - maps and quantification of habitats that may be affected
  - direct, indirect, and cumulative impacts of all facets of the project
  - detailed account, including status and distribution of federal candidate, proposed, and listed species and state-listed and locally sensitive species, including the northern sea lion, sea otter, and several species of anadromous fish (pink, chum, sockeye, and chinook salmon; steelhead; and sea-run cutthroat trout)
  - Navy should initiate section 7 consultation/conferencing and include status report of consultation activities in the EIS

- Include a risk assessment on transport of non-indigenous species to the homeport

- EIS should provide for upland disposal or treatment of contaminated dredged materials rather than nearshore or in-water disposal sites

- Give preference to modifying existing berths rather than dredging new berths

- Address increased demand for housing and services that may result in additional wetland losses

- The USFWS's initial point of contact for the PSNS-Bremerton alternative is the Western Washington Office, Lynn Childers, Federal Projects Program Supervisor at 360-753-9440

4. U.S. Department of the Interior, Fish and Wildlife Service, Western Washington Office, Olympia, Washington (letter applies to Bremerton and Everett sites)

- The USFWS letter provides details about the agency's concerns in several areas and provides suggestions for analysis and mitigation:

  - introductionof marine and estuarine exotic species
  - remediation and removal of contaminated sediment
  - wetland fills from development
  - **threatened and endangered species coordination**
  - **maximizing use of existing facilities**
  - **entrainment of organisms (Dungeness aab and shellfish) by dredging**

5. Northwest Indian Fisheries Commission *(letter also applies to Everett)*

- Impact on retained fishing rights in Puget Sound

- Impact on water quality

- NEPA requirements for tribal participation in the EIS

- Northwest Indian Fisheries Commission letter included the following attachments:

  - NWIFC Commission Roster, August 1996

- White House press release: "Government-to-Government Relations with Native American Tribal Governments" April 29, 1994
- U.S. Army Corps of Engineers Information Paper: "Riverine Gravel Mining Questions and Answers" 23 October 1995
- "Comprehensive Tribal Natural Resource Management - A Report from The Treaty Indian Tribes in Western Washington - 1996" (copy not included, original sent to John Lunz)

6. The Suquamish Tribe *(letter also applies to Everett)*

- Tribal Treaty fishing rights (share of the harvest and access to fishing places)
- Potential degradation of fish habitat
- Salmon fishing in Sinclair Inlet
- Expansion of piers and other construction may reduce fishing access
- Water quality impacts from dredging and propeller wash
- Water quality impacts from increased stormwater runoff, wastewater discharges, spills, and nonpoint sources
- Health effects from eating fish exposed to water quality contaminants
- Fish habitat impacts from lights, vibration, or other changes in the water column
- Infrastructure impacts (school overcrowding sewage spills, traffic congestion, saltwater intrusion, landfill capacity, affordable housing supply, water supply)
- Environmental justice

7. Washington State Department of Transportation

- EIS should provide traffic impact analysis to determine need for highway and other transportation improvements (include air, rail, and marine transportation)
- Stormwater runoff impacts on state highways or ferry terminals
- Noise impacts due to increased traffic
- Utilities improvements within state roadway right-of-ways

8. Washington State Parks and Recreation Commission *(letter also applies to Everett)*

- Request for a poll of sailors to identify favorite activities while in port
- Increased use of State Parks by naval personnel and dependents
- Increased need for law enforcement (naval shore patrol) at State Parks due to alcohol consumption

9. Kitsap County Board of Commissioners

- Supports homeporting USS ABRAHAM LINCOLN at PSNS

10. Economic Development Council of Kitsap County

- Supports homeporting additional CVNs at PSNS
- Attachments provide background information on schools, housing, infrastructure, and quality of life
- Economic Development Council letter included the following attachments:
  - EDC memorandum, re: Kitsap County Consensus of Homeporting Carriers in Bremerton, June 10, 1993
  - Kitsap County Board of Commissioners memorandum, re: Homeporting of Carriers in Bremerton, June 2 1993
  - Bremerton School District memorandum re: Homeporting of Carriers in Bremerton, May 26, 1993
  - Central Kitsap School District letter, May 27, 1993
  - North Kitsap School District memorandum re: Homeporting Carriers, May 25, 1993
  - South Kitsap School District No. 402 memorandum re: Homeporting Carriers, May 26, 1993

11. City of Bremerton, Washington

- Supports homeporting three CVNs at PSNS
- Impacts on fire protection and law enforcement services
- Impacts on local park and recreation services
- Impacts on City water supply and **wastewater treatment** capacity
- Impacts **of on-board wastewater effluent (high salt content) on City's treated** wastewater reuse plans
- Traffic impacts on regional and local roads
- Parking requirements
- Availability of affordable housing
- Impact on neighborhoods **of increased transient nature of residents** (renters *vs.* homeowners)
- Fiscal impact of increased need for services without corresponding increase in property tax revenues

12. City of Port Orchard, Washington
    - Supports homeporting USS ABRAHAM LINCOLN at PSNS
13. Port of Bremerton
    - Opposes homeporting *more than two* CVNs at PSNS
    - Impacts of future population growth (requires timely planning and construction)
    - The Port requests Navy support in gaming FAA funding for expansion of Bremerton National Airport
14. Port of Bremerton
    - Supports the transfer of USS ABRAHAM LINCOLN from Everett to Bremerton
15. Bremerton Area Chamber of Commerce
    - Supports the transfer of USS ABRAHAM LINCOLN from Everett to Bremerton
16. Puget Sound Naval Bases Association
    - Supports the transfer of USS ABRAHAM LINCOLN from Everett to Bremerton
17. Bremerton School District
    - School district has sufficient space for additional students associated with one additional CVN
    - Military housing in the school district is currently insufficient to allow district to fully qualify for impact aid funding
18. Kitsap County Central Labor Council
    - Supports homeporting USS ABRAHAM LINCOLN at PSNS
19. Silverdale Chamber of Commerce
    - Supports homeporting USS ABRAHAM LINCOLN at PSNS
20. Donna Butts
    - Opposes an additional CVN at PSNS (concerned about growth and urban expansion in general, which impacts: wildlife, forests, traffic, and air quality)
21. James A Collins
    - Supports homeporting additional CVNs at PSNS
22. Mr. & Mrs. Dennis Gange

- **Opposes additional CVNs at PSNS (concerned about: traffic, law enforcement, insufficient property tax revenue to support increased services, hazardous wastes)**

23. **Mr. & Mrs. Dennis Gange**

- **Letter contained newspaper clippings about hazardous waste cleanup sites in Kitsap County, including PSNS (originals sent to John Lunz)**

24. Dave Gatzke (Heartland Project Manager)

- ☠□♍□**mments (requests to be added to mailing list)**

25. Jerry Griggs (Viewcrest Villages Property Manager)

- **Supports homeporting USS ABRAHAM** LINCOLN at PSNS

26. Margaret Kirk

- Concerned about impact on public schools and the resulting effects on quality of life for the community and for navy personnel

27. Teresa Michelson, Department of Ecology, NWRO, Sediment Cleanup Specialist

- **Requests an interim opportunity for public review of alternatives, including** drawings of pier configurations

- Scope of impact analysis should include cumulative impacts of previous projects that were not adequately covered in an EIS

- CVN planning and construction should be coordinated with current environmental cleanup activities

- Any additional carriers in Puget Sound should be homeported at Everett, not PSNS

28. Russell Nickerson, USN (Ret.)

- Opposes Navy downsizing

- Opposes homeporting more ***than two CVNs*** at PSNS and ***more than one or two CVNs*** at Everett due to vulnerability to "sneak attack"

- Remember Pearl Harbor!

- **Attachment provides information** about adjacent ferry terminal (Sinclair Landing), which is under construction, and other proposed land uses

29. Mr. & Mrs. Raymond C Smith

- **Opposes** additional CVNs **at PSNS (concerned about concentration of naval forces creating an irresistible enemy target)**

30. Mrs. Timothy Thompson

- Supports homeporting USS ABRAHAM LINCOLN at PSNS (wants her husband to return home from Everett)

31. Frank Young (law enforcement officer)

- Supports homeporting a second CVN at PSNS
- Impact on law enforcement (need increased naval shore patrol)

32. Dan Zimsen

- Describe the Navy's long-range plan or master plan for expansion of PSNS
- Address the cumulative regional population impact of the proposed action and other long-range Navy development plans for PSNS
- The EIS should assess impacts on local quality of life of additional Navy personnel, many of whom have lifestyles that contrast with that of the local populace
- The EIS should address environmental impacts that may result from population increase, including: traffic (ferry crowding and "road rage"), crime (prostitution and drugs), water supply (shortages and pollution), wastewater treatment (plant capacity and septic system pollution), parking, waste disposal (landfill capacity), biological resources, geologic stability, school crowding, and contracting out of labor.

CVN HOMEPORT FACILITIES
NAVAL STATION EVERETT
SUMMARY OF EIS SCOPING ISSUES

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   - EIS should consider impacts on Native American fishing rights in Puget Sound, especially during maintenance and operation

2. U.S. Environmental Protection Agency, Region IX (letter applies to all four sites)

   - Requests 3 copies of DEIS be sent to Region IX office, Attn: D.J. Farrel, Chief
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   - US EPA provides NEPA guidance concerning: range of alternatives; project parameters (time periods, study area, region of influence); purpose and need; cumulative effects; preferred alternative, environmentally preferable alternative; nearby residential areas (environmental justice); mitigation measures (avoid, minimize, rectify, and compensate); baseline conditions; and significance criteria
   - US EPA specifies requirements for the air quality analysis
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   - US EPA specifies requirements for the biological resources analysis
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   - US EPA specifies requirements for the cultural resources analysis
   - US EPA specifies requirements for the noise analysis

3. U.S. Department of the Interior, Fish and Wildlife Service (letter applies to all four sites)

   - Homeport ships may transport non-indigenous marine organisms into nearshore habitats (water ballast in ships and seawater pipe systems)
   - USFWS specifies requirements for the biological resources analysis, including:
     - purpose and need for each alternative
     - all alternatives considered to reduce impacts

  - impacts on marine habitat, fish, shorebirds, nesting herons and egrets, burrowing owls, and federally listed species
  - mitigation plan for entraining organisms during dredging
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  - direct, indirect, and cumulative impacts of all facets of the project
  - detailed account, including status and distribution of federal candidate, proposed, and listed species and state-listed and locally sensitive species, including the northern sea lion, sea otter, and several species of anadromous fish (pink, chum, sockeye, and chinook salmon; steelhead; and sea-run cutthroat trout)
  - **Navy** should initiate section 7 consultation/conferencing and include-status report of consultation activities in the EIS
- Include a risk assessment on transport of non-indigenous species to the homeport
- EIS should provide for upland disposal or treatment of contaminated dredged materials rather than nearshore or in-water disposal sites
- Give preference to modifying existing berths rather than dredging new berths
- Address increased demand for' housing and services that may result in additional wetland losses
- The USFWS's initial point of contact for the Naval Station Everett alternative is the Western Washington Office, Lynn Childers, Federal Projects Program Supervisor at 360-753-9440

4. US. Department of the Interior, Fish and Wildlife Service, Western Washington Office, Olympia, Washington (letter applies to Bremerton and Everett sites)

- The USFWS letter provides details about the agency's concerns in several areas and provides suggestions for analysis and mitigation:
  - introduction of marine and estuarine exotic species
  - remediation and removal of contaminated sediment
  - wetland fills from development
  - threatened and endangered species coordination
  - maximizing use of existing facilities
  - entrainment of organisms (Dungeness crab and shellfish) by dredging

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- Impact on retained fishing rights in Puget Sound
- Impact on water quality
- NEPA requirements for tribal participation in the EIS

6. The Suquamish Tribe *(letter also applies to PSNS)*

- Tribal Treaty fishing rights (share of the harvest and access to fishing places)

- Potential degradation of fish habitat
- Salmon fishing in Sinclair Inlet
- Expansion of piers etc. may reduce fishing access
- Water quality impacts from dredging and propeller wash
- Water quality impacts from increased stormwater runoff, wastewater discharges, spills, and nonpoint sources
- Health effects from eating fish exposed to water quality contaminants
- Fish habitat impacts from lights, vibration, or other changes in the water column
- Infrastructure impacts (school overcrowding, sewage spills, traffic congestion, saltwater intrusion, landfill capacity, affordable housing supply, water supply)
- Environmental justice

7. Washington State Parks and Recreation Commission (letter *also applies to* *PSNS)*
    - Request for a poll of sailors to identify favorite activities while in port
    - Increased use of State Parks by naval personnel and dependents
    - Increased need for law enforcement (naval shore patrol) at State Parks due to alcohol consumption

8. Snohomish County Economic Development Council
    - Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett

9. City of Everett, Washington
    - EIS should examine consequences of the Navy's decision to establish homeport regions for the purpose of phased maintenance of surface ships
    - EIS should include a matrix comparison of the alternative homeport sites in terms of CVN support requirements and costs of construction
    - EIS should include a matrix comparison of the alternative homeport sites in terms of quality of life factors **(recreation, education, employment, transportation, social support services, etc.)**
    - EIS should consider the "willingness of a community to accept the Navy'
    - EIS should compare dredge and dredge disposal requirements for each alternative homeport site
    - EIS should compare additional facilities construction and permitting requirements at each alternative homeport site
    - EIS should address impacts on traffic, public transportation, and parking

- EIS should address air and water pollution impacts
- EIS should address utilities and public services impacts (water, sewer, stormwater, water treatment, fire, electrical, natural gas, telephone, television, fiber optics, wireless communication, police, and other municipal services)
- EIS should address housing cost and availability
- EIS should include a survey of sailors and family members to determine preference between homeporting at Everett or Bremerton
- EIS should evaluate possible homeporting mixes at Everett that would maintain personnel loading with different ships
- EIS should evaluate an option that would homeport two CVNs at Everett
- The DEIS should contain language that identifies the "preferred option"
- A list of issues to be addressed in the DEIS (a scoping report) should be made public
- The City requests an update meeting with the Navy and SAIC during mid-summer to ensure critical issues are receiving adequate identification

10. City of Marysville, Washington

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett
- The City, local jurisdictions, and citizens are willing to work with the Navy to develop solutions
- The City requests a workshop during early in the NEPA process to consider EIS evaluation methodologies and techniques
- EIS should consider impact on quality of life of local community if USS ABRAHAM LINCOLN leaves Everett

11. Port of Everett

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett

12. Everett Area Chamber of Commerce

- EIS should assess adverse economic impacts of relocating USS ABRAHAM LINCOLN away from Everett
- EIS should assess beneficial impacts of locating additional ships at Everett

13. Navy League of the United States

- Statement in support of the Pacific Fleet EIS for CVN homeporting

14. Navy League of the United States

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett

15. Navy League of the United States

- Everett has navigation and maneuvering advantages over Bremerton
- Rich Passage into Bremerton is a challenging (risky) transit
- Favors a second carrier at Everett

16. Port & Starboard Rent-A-Car Agency

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett

17. Port Gardner Information League

- Opposes homeporting of CVNs at NAVSTA Everett
- EIS should evaluate NAVSTA Everett as a regional center for the naval reserve
- Port Gardner Information League letter included the following enclosures:
  - PGIL paper entitled “I Never Promised You a Rose Garden” September 1996
  - Several newspaper clippings

18. Snohomish County-Camano Association of Realtors

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett

19. Master Builders Association of King and Snohomish Counties

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett

20. Dennis Atkinson

- A CVN homeport at NAVSTA Everett provides a quicker and safer access to the open sea than a CVN homeport at PSNS

21. Jack N. Casseday, CDR USN (Ret.)

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett
- A CVN homeport at NAVSTA Everett provides a quicker and easier access to the open sea than a CVN homeport at PSNS

22. Charles A. Forbes

- Supports moving the USS ABRAHAM LINCOLN to PSNS
- Snohomish County currently has a shortage of law enforcement personnel

- Snohomish County currently has a housing shortage

23. Gary Gorder

- Opposes Navy presence in his community

24. Daniel W. Knopp

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett

25. Kris Krischano

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett
- A CVN homeport at NAVSTA Everett provides a quicker and easier access to the open sea than a CVN homeport at PSNS

26. Nancy L. McLaren

- Supports keeping USS ABRAHAM LINCOLN at NAVSTA Everett

27. Dale H. Moses

- Supports strong Navy presence at NAVSTA Everett
- Expresses questions and concerns related to CIVMARs, AOEs, CV yellow gear facility, and PIA
- Suggests using "sailor-days&port" to measure growth related issues like traffic, economics, recreation, etc.
- AOE dependents are more likely to permanently move to Everett than CVN dependents
- Four AOEs would produce a more steady port loading factor than one CVN

28. Alison W. Sing

- EIS should address ability of each site to recover from earthquake, flood, landslide, wind storm, tidal wave
- EIS should address availability of emergency medical services, hazardous material response, medical personal, communications recovery

CVN HOMEPORT FACILITIES
PEARL HARBOR - HONOLULU
SUMMARY OF EIS SCOPING ISSUES

1. U.S. Environmental Protection Agency, Region IX (letter applies to all four sites)

   - Requests 3 copies of DEIS be sent to Region IX office, Attn: D.J. Farrel, Chief
   - EIS should include a full analysis of impacts related to dredging and sediment disposal, specifically impacts on: biological resources, geologic resources, air quality, hydrologic resources, water quality, and relevant treatment technologies
   - EIS should also address: aesthetics, cultural resources, health and safety, so&economics, environmental justice, and cumulative impacts
   - US EPA provides NEPA guidance concerning: range of alternatives; project parameters (time periods, study area, region of influence); purpose and need; cumulative effects; preferred alternative, environmentally preferable alternative; nearby residential areas (environmental justice); mitigation measures (avoid, minimize, rectify, and compensate); baseline conditions; and significance criteria
   - US EPA specifies requirements for the air quality analysis
   - US EPA specifies requirements for the land use, plans, and policies analysis
   - US EPA specifies requirements for wetlands, water quality, and section 404 analyses
   - US EPA specifies requirements for the biological resources analysis
   - US EPA specifies requirements for addressing waste and hazardous materials (health and safety analysis), including pollution prevention, energy conservation, waste minimization, and health impacts from fish consumption (subsistence fishing)
   - US EPA specifies requirements for the cultural resources analysis
   - US EPA specifies requirements for the noise analysis

2. United States Department of Agriculture, Natural Resources Conservation Service

   - Nocomments

3. U.S. Department of the Interior, Fish and Wildlife Service (letter applies to all four sites)

   - Homeport ships may transport non-indigenous marine organisms into nearshore habitats (water ballast in ships and seawater pipe systems)
   - USFWS specifies requirements for the biological resources analysis, including:
     - purpose and need for each alternative
     - all alternatives considered to reduce impacts
     - impacts on marine habitat, fish, shorebirds, and federally listed species

  - mitigation plan for entraining organisms during dredging
  - maps and quantification of habitats that may be affected
  - direct, indirect, and cumulative impacts of all facets of the project
  - detailed account, including status and distribution of federal candidate, proposed, and listed species and state-listed and locally sensitive species
  - Navy should initiate section 7 consultation/conferencing and include status report of consultation activities in the EIS
- Include a risk assessment on transport of non-indigenous species to the homeport
- EIS should provide for upland disposal or treatment of contaminated dredged materials rather than nearshore or in-water disposal sites
- Give preference to modifying existing berths rather than dredging new berths
- Address increased demand for housing and services that may result in additional wetland losses
- The USFWS's initial point of contact for the Pearl Harbor alternative is the Pacific Islands Office, Pacific Islands Ecoregion Manager at 808-451-2749

4. State of Hawaii, Office of Planning

- Supports homeporting a CVN at Pearl Harbor
- Beneficial economic impacts (jobs and construction spending)
- Impacts on public infrastructure and services (including: schools, traffic, social services,. health services, housing)
- Coastal Zone Management Consistency Determination, issues include:
  - nuclear fuel and waste transport, storage, and disposal
  - wastewater and cooling water discharge
  - ballast water discharge
  - dredging and spoils disposal
  - support activities and facilities
  - aquatic resources (biological, recreational, and economic)
  - threatened and endangered species (Hawaiian stilt, gallinule, coot, duck, and green turtle)

5. State of Hawaii, Department of Education, Hawaii State Public Library System

- Requests copy of the EIS

6. State of Hawaii, Department of Health

- EIS should address wastewater disposal plans for the CVN while in Pearl Harbor

7. Tom Okamura, State Representative, 33rd District

- Supports homeporting a CVN at Pearl Harbor

8. City and County of Honolulu, Planning Department
   - Conformance with plans, objectives, and policies of City and County of Honolulu, including the General Plan and the Development Plan (common and special provisions and land use and public facilities maps)
   - EIS should address: project timing, scope, physical characteristics, costs, and background information
   - Remediation of existing pollution in areas of Pearl Harbor affected by the project
   - Community and environmental concerns related to nuclear power and weaponry
   - Increase in Pearl Harbor's perceived value as a strategic target and impact on viability of Pearl Harbor as a world-class vacation destination
   - Population-related impact on government services, infrastructure, and housing
   - Traffic impacts
   - Employment impacts
9. City and County of Honolulu, Board of Water Supply
   - Nocomments
10. Pearl City Neighborhood Board No. 21
    - Impacts on "shore services" such as: schools, housing, and traffic
    - Concerns about safe handling of nuclear materials (CVN "fueling and defueling")
11. American Friends Service Committee, Hawai'i Area Program Office
    - Opposes homeporting of CVNs at Pearl Harbor
    - Concerned about: nuclear safety, return of Hawaiian lands, Hawaiian cultural rights, economic issues, biological resources, water quality, hazardous waste cleanup, dredging, cumulative impacts
    - Opposes military spending
    - Requests copies of the San Diego EIS for Honolulu public libraries
12. Federal Managers Association, Chapter 19, Pearl Harbor Shipyard/Area
    - Supports homeporting a CVN at Pearl Harbor
13. Hawaii Island Economic Development Board
    - Supports increased U.S. Navy presence at Pearl Harbor

14. National Association of Superintendents **of U.S. Shore Establishments,** Pearl Harbor

    - Supports homeporting a CVN at **Pearl Harbor**

15. Sierra Club, Hawai'i Chapter

    - "The stationing of nuclear powered carriers in Hawai'i is inconsistent with the State Constitution and the state's coastal zone management act." (Article XI, section 8 of the State Constitution prohibits construction of nuclear power plants in Hawai'i without legislative approval)
    - EIS should address accidental release of radioactive materials, including probability of release, impacts on native species and human health, and evacuation plans
    - EIS should address radioactive waste disposal

16. Plutonium -Free Future

    - Opposes any U.S. Navy presence in Hawai'i

17. Carol Aiken

    - Opposes any increased U.S. Navy presence in Hawai'i
    - Environmental concerns include:
        - radioactive waste disposal (historic and future)
        - economic burden on school system
        - population crowding and increased traffic
        - cleanup of existing Superfund sites in Hawaii
        - local jobs taken by military dependents and retired military
        - water supply and water quality

18. Brian D. Bott

    - Conditionally supports homeporting two CVN groups at Pearl Harbor
    - Operational concerns:
        - size of the harbor
        - size of the port (support facilities and housing)
        - availability of suitable air bases for the aircraft
        - availability and cost of housing for crew and dependents

19. Paul Brenner

    - Opposes homeporting of CVNs at Pearl Harbor
    - Concerned about current and future pollution in the harbor

20. Dave Gonzales

    - Opposes homeporting of CVNs at Pearl Harbor

- Concerned about disposal of spent nuclear fuel rods
- Supports return of Hawaii to the original inhabitants

21. Linda A. Hatcher

- Opposes homeporting of CVNs at Pearl Harbor
- Pearl Harbor is already on the Superfund list and little cleanup has been done
- Dredging in the harbor might stir up hazardous pollutants
- Nuclear waste disposal is a problem

22. Michael Jones

- EIS should consider health and safety issues, including:
  - handling of radioactive water and other radioactive waste
  - refueling of CVN reactors and handling of radioactive spent fuel
  - transfer of aircraft between carrier and shore
  - transfer of weapons between carrier and shore
  - aircraft training and other operations near Honolulu International Airport
- EIS should consider land use issues, including:
  - storage of weapons for CVN
  - storage of fuel for CVN
  - maintenance and storage facilities for aircraft

23. Young Kim

- Opposes homeporting of CVNs at Pearl Harbor, for the following reasons:
  - Planned closure of NAS Barbers Point leaves no airfield for CVN aircraft
  - Impact on public schools
  - **Impact on traffic** (H-l and H-2)

24. Kaonohi Malama

- Opposes homeporting of CVNs at Pearl Harbor, for the following reasons:
  - Planned closure of NAS Barbers Point leaves no airfield for CVN aircraft
  - Insufficient mooring space in Pearl Harbor
  - Transfer of Kaho'olawe Island to the state leaves no target area for air-to-ground attack exercises
  - Impact on local housing, which is already in shortage
  - Cultural resources concerns (native Hawaiian access to ancestral gathering places)

APPENDIX C

NOISE

APPENDIX C

BACKGROUND INFORMATION REGARDING NOISE

Noise is generally defined as unwanted or annoying sound that is typically associated with human activity and that interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise; the perceived importance of the noise and its appropriateness in the setting; the time of day and the type of activity during which the noise occurs; and the sensitivity of the individual.

NOISE MEASUREMENT AND NOISE TERMINOLOGY

Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB). Most of the sounds we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies differing in sound level (see Table C-l). The intensities of each frequency add to generate sound. This method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound according to a weighting system that reflects that human hearing is less sensitive at low frequencies and at extremely high frequencies than at the midrange frequencies. This is called "A" weighting, and the dB level measured is called the A-weighted sound level (dBA). In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve.

Although the dBA may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources that creates a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors L_{10}, L_{50}, and L_{90} are commonly used. They are the noise levels equaled or exceeded during 10 percent, 50 percent, and 90 percent of stated time. A single descriptor called the L_{eq} (equivalent sound level) is also used. L_{eq} is the energy-mean dBA during a stated measured time interval.

Community Noise Equivalent Level (CNEL) is the weighted average sound level for a 24-hour day. It is calculated by adding 5 dBs to noise during the evening (7:00 P.M. to 10:00 P.M.) and 10 dBs to noise during the night (10:00 P.M. and 7:00 A.M.). The penalty is assigned to account for the increased sensitivity to noise during the quiet hours. A second metric frequently used in noise studies is the L_{dn} (Day-Night Average Noise Level), which is similar to CNEL but does not include a penalty for noise during the evening. CNEL is approximately 1 dB higher than L_{dn}.

NOISE ATTENUATION CALCULATION

Noise attenuation is influenced by three primary factors: dissipation of sound with distance, atmospheric absorption, and barrier effects. Secondary factors that influence sound reduction are the reflection of sound waves and ground absorption.

Dissipation of sound with distance, **Sound levels decrease with increasing distance from a source.** For point sources, such as a bulldozer, **sound levels decrease 6dBA for each doubling of distance. (For instance, if** at **500 feet the-sound level is'60 dB, at 1,000 feet the sound level would be reduced by 6 dBA to 54 dB.) For line sources, such as a road, sound levels decrease approximately 3 dBA** for each doubling of distance.

Atmospheric absorption. In addition to dissipation of sound with distance, sound wave reduction also depends upon the frequencies of the source. High frequencies are absorbed more than lower frequencies. In general, sound energy for frequencies from 31.5 to 125 Hz (hertz = cycles per second) is not reduced by more **than 1 dBA** at distances up to 5,000 feet; however, sound energy above 2,000 Hz is reduced to very low levels at these distances.

Barrier ***effects.*** Barriers, such as topography or structures, between the noise source and a **noise-**sensitive **receptor can reduce noise levels** by reflecting the sound energy back towards the source and by increasing the distance sound must travel to reach receptors. Barrier effects also vary with frequency of the sound and can vary widely over a given area. Generally, intervening hills provide the greatest barrier effect with a potential maximum reduction of approximately 24 **dB.**

Reflection of *sound waves,* Sound waves can reflect off hard surfaces and affect surrounding areas with noise levels above those calculated by the dissipation by distance calculations. In particular, during soil collection operations, a bulldozer may be operating on a slope directly in front of a steep graded hillside. If the soil on the slop is hard-packed and unvegetated, sound levels can be increased in the surrounding areas. Reflections from a single slope can increase transmitted noise levels by 1 to 3 **dB.**

Ground ***absorption.*** Over stretches of soft ground surface (vegetated or freshly tilled) sound can be absorbed. A reduction of 1.5 **dB** per doubling distance is typical of this effect.

U.S. NAVY STANDARDS AND GUIDELINES REGARDING NOISE ABATEMENT

The Environmental and Natural Resources *Protection Manual* OPNAVINST **5090.1A,** Chapters 16 and 17, set the standards and guidelines by which Naval facilities must operate regarding noise abatement. Both onshore and shipboard activities are addressed. Chapter 16, paragraph 4.1 directs that federal facilities must **". ..comply** with all requirements, substantive or procedural, applicable to environmental noise abatement. Requirements means all applicable federal requirements pursuant to the Noise Control Act and applicable boundary noise limits established by state and local law." Regarding **onboard** ship procedures, Chapter 17, paragraph 5.9.1 states, "The use of powered tools, machinery, outboard loudspeakers, or any other devices which emit excessive noise, either directly or indirectly through reradiation, shall be restricted to normal daylight working hours to the maximum possible extent."

Table C-l
Typical Sound Levels Measured **in the Environment**

At a Given Distancefrom Noise Source	*A- Weigh ted Sound Level in Decibels*	*Noise Environments*	*Subjective Impression*
	140		
Civil defense siren (100')			
	130		
Jet takeoff (200')	120		Pain threshold
	110	Rock music concert	
Pile driver (50') Ambulance siren (100')	loo		Very loud
	90	Boiler room	
Freight cars (50') Pneumatic drill (50')	80	Printing press plant In kitchen with garbage disposal running	
	70		Moderately loud
Vacuum cleaner (10')	60	Data processing center Department store	
Light traffic (loo') Large transformer (200')	50	Private business office	
	40		Quiet
Soft whisper (5')	30	Quiet bedroom	
	20	Recording studio	
	10		Threshold of hearing
	0		

Source: U.S. Department of Housing and Urban Development 1985.

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APPENDIX D

CLASSIFIED ASPECTS OF CVN DESIGN, OPERATION, AND SAFETY

APPENDIX D

CLASSIFIED ASPECTS OF CVN DESIGN, OPERATION, AND SAFETY

(CLASSIFIED)

APPENDIX E

INFORMATION ON RADIATION EXPOSURE AND RISK

APPENDIX E
INFORMATION ON RADIATION EXPOSURE AND RISK

1.0 INFORMATION ON RADIATION EXPOSURE

Radiation is the release of energy from radioactive materials. The levels of the energy released vary greatly. The length of time radioactive material continues to release energy also varies greatly, from several seconds to thousand of years. The energy particles released by radioactive material travel in surrounding air and material until the excess energy is dissipated by subatomic collisions. These collisions may have a detrimental effect on biological tissue. A measurement of damage to biological tissues known as the roentgen-equivalent-man (rem) is the standard used to assess the effects of the energy released from radiation. One millirem, a common subunit of the rem, is 1/1000th of a rem.

Radiation can be broken down into two basic categories: ionizing and non-ionizing. This section deals with ionizing radiation, which has enough energy to change an atom's structure. Low energy radiation given off by devices such as television, radio, or microwave ovens is non-ionizing and is not considered here.

Radiation is present everywhere in the environment in naturally occurring elements and from cosmic sources. These natural sources make up what is known as 'background radiation." Humans are also routinely exposed to radiation from medical examinations and sometimes from therapy. Some consumer products, such as smoke detectors, also contain radioactive sources and contribute a small amount to overall exposure. The typical person living in the United States is exposed to about 360 millirem of radiation annually, mostly from natural sources (National Academy of Sciences 1990). The pie chart in Figure E-1 illustrates the percentage attributed to various sources of radiation.

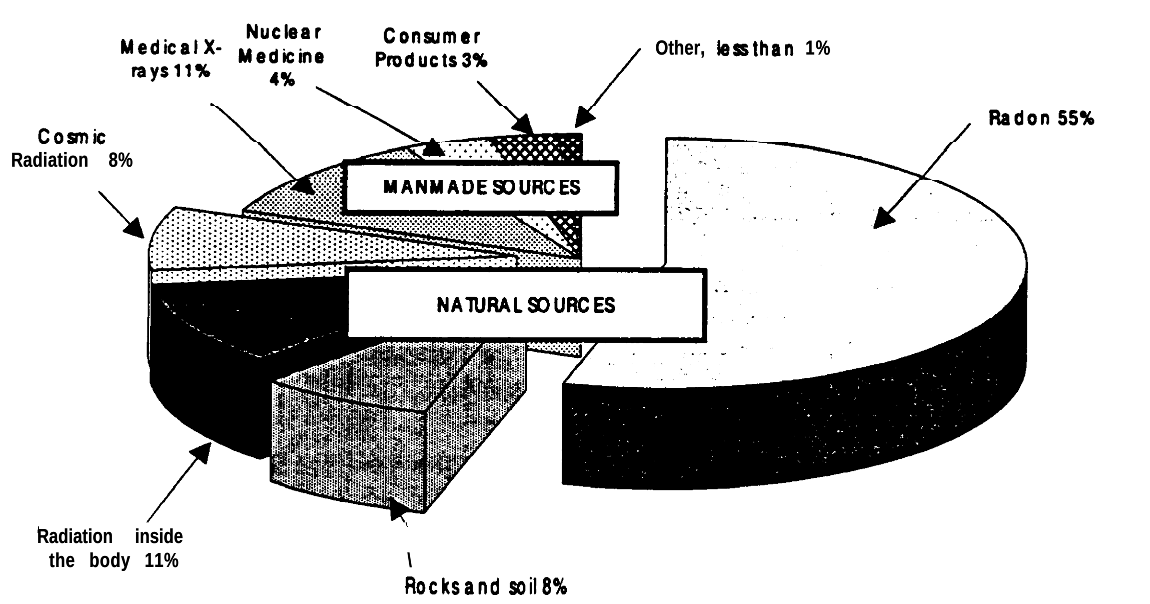

Figure E-1. Contributing Sources of Natural and Manmade Radiation for the Average American

The average person living in the U.S. receives about 295 millirem per year from natural sources and 65 millirem per year from man-made sources. Man-made sources are mostly from medical uses. Radon is by far the largest natural source of exposure (200 millirem per year). It originates below the Earth's surface in certain geological formations and rises to ground level where people are exposed to it. Radon gas is often trapped and lingers in well-insulated buildings. Also, just being outdoors results in exposure to natural sources of cosmic radiation. A person living in Colorado receives 40 millirem per year more than a person living in New York. A round-trip flight from the U.S. to Europe would result in an additional 10 millirem each way. For comparison with a man-made source, a typical chest X-ray gives a dose of from 10 to 40 millirem.

Since 1974 the Naval Nuclear Propulsion Program (NNPP) has used thermoluminescent dosimeters (TLDs) as the primary means to measure radiation exposure of Navy personnel. It is characteristic of thermoluminescent material that radiation causes internal changes that make the material, when heated, give off an amount of light directly proportional to the radiation dose.

Control of radiation exposure in the NNPP has always been based on the assumption that any exposure, no matter how small, involves some risk; however, exposure within the accepted exposure limits represents a small risk when compared with normal hazards of life. The basis for this statement is presented below.

2.0 EXPOSURE TO RADIATION MAY INVOLVE SOME RISK

Since the inception of nuclear power, scientists have cautioned that exposure to ionizing radiation in addition to that from natural background may involve some risk The National Committee on Radiation Protection and Measurements (NCRPM) in 1954 (NCRPM 1954) and the International Commission on Radiological Protection (ICRP) in 1958 (ICRP 1959) both recommended that exposures should be kept as low as practicable and that unnecessary exposure should be avoided to minimize this risk. The ICRP in 1962 (ICRP 1964) explained the assumed risk as follows:

> The basis of the Commission's recommendations is that any exposure to radiation may carry some risk. The assumption has been made that, down to the lowest levels of dose, the risk of inducing disease or disability in an individual increases with the dose accumulated by the individual, but is small even at the maximum permissible levels recommended for occupational exposure.

The National Academy of Sciences-National Research Council Advisory Committee on the Biological Effects of Atomic Radiation included similar statements in its reports in 19561961 and most recently in 1990 (National Academy of Sciences 1990). In 1960, the Federal Radiation Council (FRC)stated that its radiation protection guidance did not differ substantially from recommendations of the NCRPM, the ICRP, and the National Academy of Sciences (FRC 1960). This statement was again reaffirmed in 1987 (EPA 1987a).

One conclusion from these reports is that radiation exposures to personnel should be minimized. This is not a new conclusion. It has been a major driving force of the NNPP from its inception.

3.0 RADIATION EXPOSURE COMPARISONS

The success of the NNPP in minimizing exposures to personnel can be evaluated by making some radiation exposure comparisons. One important measure of NNPP personnel exposure is annual exposure, the amount of exposure an individual receives in a year. Since 1980, no individual has exceeded 2 rem in a year while working in the NNPP. Also, the average exposure per person monitored since 1980 is about 0.05 rem for Fleet personnel and 0.13 rem for Shipyard personnel. The following comparisons give perspective on these **individual** annual doses in comparison to federal limits and other exposures:

- The maximum individual annual dose of 2 rem is less than the federally allowed individual quarterly dose of 3 rem.
- The maximum individual annual dose of 2 rem is less than one-half the federal annual limit of 5 rem.
- Although no person in the NNPP has exceeded 2 rem in a year since 1980, between 400 and 7,000 workers at NRC-licensed commercial nuclear reactors have exceeded 2 rem in each year over this same period (NRC 1996).
- The average annual exposure of 0.05 rem for Fleet personnel is:
  - one-hundredth of the federal annual limit of 5 rem
  - about one-third of the average annual exposure of commercial nuclear power plant personnel (NRC 1996).
  - about one-third of the average annual exposure received by U. S. commercial airline flight crew personnel due to cosmic radiation (NRCPM 1989a).
- The average annual exposure of 0.13 rem for Shipyard personnel is:
  - about one-fortieth of the federal annual limit of 5 rem
  - less than the average annual exposure of commercial nuclear power plant personnel (NRC 1996).
  - less than the average annual exposure received by U. S. commercial airline flight crew personnel due to cosmic radiation (NRCPM 1989a).

For additional perspective, the annual exposures for personnel in the NNPP may also be compared to natural background and medical exposures:

- The average annual exposure of 0.05 rem for Fleet personnel is:
  - less **than one-fifth the average annual exposure to someone living in the U.S. from** natural background radiation (NRCPM 1987b).

- slightly less than the difference in the annual exposure due to natural background radiation between Denver, Colorado and Washington, D.C. (NRCPM 1987b).

Fleet personnel operating nuclear-powered submarines receive less total annual exposure than they would if they were stationed on shore performing work not involving occupational radiation exposure. This exposure is less because of the effectiveness of the shielding aboard ship and because the low natural background radiation in a steel hull submerged in the ocean is less than the natural background radiation from cosmic, terrestrial, and radon sources on shore.

- The average annual exposure of 0.13 rem for Shipyard personnel is:
  - less than one-half of the average annual exposure that someone living in the U.S. would receive from natural background radiation (NRCPM 1987b).
  - about the same as the exposure from common diagnostic medical x-ray procedures such as x-rays of the back (NRCPM 1989b).

4.0 STUDIES OF THE EFFECTS OF RADIATION ON HUMANS

Observations on the biological effects of ionizing radiation began to be made soon after the discovery of x-rays in 1895 (National Academy of Sciences 1990).

Numerous references are made in the early literature concerning the potential biological effects of exposure to ionizing radiation. These effects have been intensively investigated for many years (Upton 1982). Although there still exists some uncertainty about the exact level of risk, the National Academy of Sciences has stated: "It is fair to say that we have more scientific evidence on the hazards of ionizing radiation than on most, if not all, other environmental agents that affect the general public" (National Academy of Sciences 1980).

A large amount of experimental evidence of radiation effects on living systems has come from laboratory studies on cell systems and on animals. However, what sets our extensive knowledge of radiation effects on humans apart from other hazards is the evidence that has been obtained from studies of human populations that have been exposed to radiation in various ways (National Academy of Sciences 1980). The health effects demonstrated from studies of people exposed to high doses of radiation (that is, significantly higher than current occupational limits) include the induction of cancer, cataracts, sterility, and developmental abnormalities from prenatal exposure. Animal studies have documented the potential for genetic effects.

Near the end of 1993, the Secretary of Energy requested the disclosure of all records and information on radiation experiments involving human subjects performed or supported by Department of Energy or predecessor agencies. The NNPP has never conducted or supported any radiation experiments on humans. As discussed in this report, the NNPP has adopted exposure limits recommended by national and international radiation protection standards committees, such as the NCRMP and the ICRP, and has relied on conservative designs and disciplined operating and maintenance practices to minimize radiation exposure to levels well below these limits.

5.0 HIGH DOSE STUDIES

The human study populations that have contributed a large amount of information about the biological effects of radiation exposure include the survivors of the atomic bombings of Hiroshima and Nagasaki, x-rayed tuberculosis patients, victims of various radiation accidents, patients that have received radiation treatment for a variety of diseases, radium dial painters, and inhabitants of South Pacific islands that received unexpected doses from fallout due to early nuclear weapons tests. All of these populations received high or very high exposures.

The studies of atomic bomb survivors have provided the single most important source of information on the immediate and delayed effects of whole-body exposure to ionizing radiation. The studies have been supported for over 40 years by the U.S. and Japanese governments and include analysis of the health of more than 100,000 survivors of the bombings. Continued follow-up of the Japanese survivors has changed the emphasis of concern from genetic effects to the induction of cancer (Boice 1990).

The induction of cancer has been the major late effect of radiation exposure in the atomic bomb survivors. The tissues most sensitive to the induction of cancer appear to be the bone marrow, thyroid, and female breast. Other cancers linked to radiation, but with a lower sensitivity, include cancers of the lung, stomach, colon, bladder, and esophagus. A wave-like pattern of leukemia induction was seen over time beginning about 2 years after exposure, peaking within 10 years of exposure, and diminishing to near baseline levels after 30 years. For other cancers, a statistically significant excess was observed 10 or more years after exposure, and the excess risk continues to rise slowly with time (Shimizu 1990).

While it is often stated that radiation causes all forms of cancer, many forms of cancer actually show no increase among atomic bomb survivors. These include chronic lymphocytic leukemia, Hodgkin's disease, and cancers of the liver, pancreas, prostate, and testis (Boice 1990).

To understand the impact of cancer induction from the atomic bombings, it is necessary to compare the number of radiation-related cancers to the total number of cancers expected in the exposed group. In a study subgroup of over 40,000 survivors with doses in the range of 1 rad to 400 rads from the bombings, 3,435 had died from cancer by 1985. Of these, 340 cancer deaths are attributed to radiation exposure (Shimizu 1990). At doses below 20 rads, the Japanese data have not revealed a statistically significant excess of cancer (United Nations Scientific Committee on the Effects of Atomic Radiation [UNSCEAR] 1988). The cancer mortality experience of the other human study populations exposed to high doses referenced above is generally consistent with the experience of the Japanese atomic bomb survivors (National Academy of Sciences 1990).

About 30 years ago the major concern of the effects from radiation exposure centered on possible genetic changes. Ionizing radiation was known to cause such effects in many species of plants and animals. However, intense study of nearly 70,000 offspring of atomic bomb survivors has failed to identify any increase in genetic effects. Based on a recent analysis, humans now appear less sensitive to genetic effects from radiation exposure than previously thought (Boice 1990).

Radiation-induced cataracts have been observed in atomic bomb survivors and persons treated with very high doses of x-rays to the eye. About 20 years ago, potential cataract induction was considered a matter of concern. However, more recent research indicates the induction of cataracts by radiation requires a high threshold dose. The National Academy of Sciences has stated the threshold for a vision-impairing cataract under conditions of protracted exposure is thought to be no less than 800 rem, which greatly exceeds the amount of radiation that can be accumulated by the lens through occupational exposure to radiation under normal working conditions (National Academy of Sciences 1990).

Radiation damage to the reproductive cells at very high doses has been observed to result in sterility. Impairment of fertility requires a dose large enough to damage or deplete most of the reproductive cells and is close to a lethal dose if exposure is to the whole body. The National Academy of Sciences estimates the threshold dose necessary to induce sterility in either the male or female is about 350 rem, or more, in a single dose (National Academy of Sciences 1990). As in the case of cataract induction, this dose far exceeds the dose that can be received from occupational exposure under normal working conditions.

Developmental abnormalities were observed among children of the atomic bomb survivors that received high prenatal exposure (that is, their mother was pregnant at the time of the exposure). These abnormalities included stunted growth, small head size, and mental retardation. Additionally, recent analysis suggests that during a certain stage of development (the 8th to 15th week of pregnancy) the developing brain is especially sensitive to radiation. A slight lowering of IQ might follow even relatively low doses of 10 rem or more (National Academy of Sciences 1990).

From this discussion of the health effects observed in studies of human populations exposed to high doses of radiation, it can be seen that the most important of the effects from the standpoint of occupationally exposed workers is the potential for induction of cancer (National Academy of sciences 1990).

6.0 LOW DOSE STUDIES

The cancer-causing effects of radiation on the bone marrow, female breast, thyroid, lung, stomach, and other organs reported for the atomic bomb survivors are similar to findings reported for other irradiated human populations. With few exceptions, however, the effects have been observed only at high doses and high dose rates. Studies of populations chronically exposed to low-level radiation have not shown consistent or conclusive evidence of an associated increase in the risk of cancer (National Academy of Sciences 1990). Attempts to observe increased cancer in human populations exposed to low doses of radiation have been difficult.

One problem in such studies is the number of people needed to provide enough data. As the dose to the exposed group decreases, the number of people needed to detect an increase in cancer goes up at an accelerated rate. For example, for a group exposed to 1 rem (equivalent to the average lifetime accumulated dose in the NNPP) it would take more than 500,000 people in order to detect an excess in lung cancers based on current estimates of the risk (Shore 1990). This is more than three times the number of persons that have performed nuclear work in all the Naval shipyards over the last four decades. Another limiting factor is the relatively short time since large groups of people began receiving low doses of occupational radiation. As discussed previously, data from the atomic bomb survivors indicates a long latency period between the time of exposure and expression of the disease.

There is also the compounding factor that cancer is a generalization for a group of about 300 separate diseases, many being relatively rare and having different apparent causes. It is difficult to analyze low dose study data to eliminate the possibility that some factor other than radiation may be causing an apparent increase in cancer induction. This difficulty is particularly apparent in studies of lung cancer, where smoking is such a common exposure, is poorly documented as to individual habits, and is by far the primary cause of lung cancer. because cancer induction is random in nature, low dose studies are limited by the fact that an apparent observed small increase in a cancer may be due to chance alone.

Despite the lack of consistent or conclusive evidence from low dose studies to date, these studies fulfill an important function. They are the only means available for eventually testing the validity of current risk estimates derived from data accumulated at higher doses and higher dose rates.

Low dose groups that have been or are being studied include groups exposed as a result of medical procedures, exposed to fallout from nuclear weapons testing, living near nuclear installations, living in areas of high natural background radiation, and occupationally exposed to low doses of radiation. The National Academy of Sciences has reviewed a number of the low dose studies in National Academy of Sciences 1980 and 1990. Their overall conclusion from reviewing these studies was as follows:

> Studies of populations chronically exposed to low-level radiation, such as those residing in regions of elevated natural background radiation, have not shown consistent or conclusive evidence of an associated increase in the risk of cancer. (National Academy of Sciences 1990)

This conclusion has been supported by studies that have been completed since National Academy of Sciences 1990 was published. For example, in 1990, the National Cancer Institute completed a study of cancer in populations living near 62 nuclear facilities in the U.S. that had been in operation since before 1982. This study included commercial nuclear power plants and Department of Energy facilities that used radioactive materials. The conclusion of the National Cancer Institute study was as follows:

> There was no evidence to suggest that the occurrence of leukemia or any other form of cancer was generally higher in the (counties near the nuclear facilities) than in the (counties remote from nuclear facilities). (NCI 1990)

At the request of the Three Mile Island Public Health Fund, independent researchers investigated whether or not the pattern of cancer in the 10-mile area surrounding the Three Mile Island nuclear plant had changed after the TMI-2 accident in March 1979 and, if so, whether the change related to radiation releases from the plant. A conclusion of this study was as follows:

> For accident emissions, the authors failed to find definite effects of exposure on the cancer types and population subgroups thought to be most susceptible to radiation. No associations were seen for leukemia in adults or for childhood cancers as a group. (Hatch 1990)

Of particular interest to workers in the NNPP are studies of groups occupationally exposed to radiation. A recent survey of radiation worker populations in the U.S. shows there are about

350,000 workers currently under study (Shore 1990). For more than a decade, NNPP personnel, including those at shipyards and in the Fleet, have been included among populations being studied. These studies are discussed below.

In 1978, Congress directed the National Institute for Occupational Safety and Health (NIOSH) to perform a study of workers at the Portsmouth Naval Shipyard (PNS). This study was in response to an article in the Boston Globe newspaper describing research by Dr. T. Najarian and Dr. T. Colton, assisted by the Boston Globe staff. The report alleged that Portsmouth workers who were occupationally exposed to low-level radiation suffered twice the expected rate of overall cancer deaths and five times the expected rate of leukemia deaths. Congress also chartered an independent oversight committee of nine national experts to oversee the performance of the study to assure technical adequacy and independence of the results. The following is a summary of the study and its results. NIOSH prepared this summary at the conclusion of their last study phase in February 1986.

> In December, 1980, NIOSH researchers completed the first report on a detailed study of the mortality among employees of the shipyard. Included in the study were all those who had been employed at PNS since January 1, 1952 (the earliest date that records existed that could identify former employees). In this report it was concluded that 'Excesses of deaths due to malignant neoplasms and specifically due to neoplasms of the blood and blood-forming tissue, were not evident in civilian workers at PNS...' in contrast to the results of the original study conducted by the physician. Later, in an investigation to determine why the physician's study results differed so greatly from the NIOSH study, a number of shortcomings in his original study were found that resulted in incorrect conclusions.
>
> To make more certain that workers who had died from leukemia did not die because of radiation exposures received at the shipyard, a second study was conducted. That study compared the work and radiation histories of persons who died of leukemia, with persons who did not. In this analysis, again, no relationship was found between leukemia and radiation, although the NIOSH researchers were unable to rule out the possibility of other occupational exposures having a role.
>
> In this current and third NIOSH paper, we investigated the role that radiation and other occupational exposures at the shipyard may have had in the development of lung cancer. This study is an outgrowth of an observation made in the 1980 NIOSH study referred to above. The observation was that persons with greater than 1 rem cumulative exposure to radiation had an increase in lung cancer.
>
> In this report entitled "Case Control Study of Lung Cancer in Civilian Employees at the Portsmouth Naval Shipyard," we compared the work and radiation histories of persons who died of lung cancer with persons who did not. We found that persons with radiation exposures in excess of 1 rem had an excess risk of dying of lung cancer, but the radiation was in all likelihood not the cause. This was due to the fact that persons with radiation exposure tended also to have exposure to asbestos (a known lung carcinogen) and to welding by-products (suspected to contain lung carcinogens).

Thus, the earlier reports of excess cancer rates among PNS workers exposed to low-level radiation were not substantiated by NIOSH. The NIOSH studies were published in scientific literature (Rinsky 1981; Greenburg 1985; Stem 1986; Rinsky 1988).

In 1991, researchers from the Johns Hopkins University, Baltimore, Maryland, completed a more comprehensive epidemiological study of the health of workers at the six Navy shipyards and two private shipyards that service Navy nuclear-powered ships (Matanoski 1991). This independent study evaluated a population of 70,730 civilian workers, beginning with the first overhaul of the first nuclear-powered submarine, USS NAUTILUS, in 1957 and ending in 1981, to determine whether there was an excess risk of leukemia or other cancers associated with exposure to low levels of gamma radiation.

This study did not show any cancer risks linked to radiation exposure. Furthermore, the overall death rate among radiation-exposed shipyard workers was less than the death rate for the general US. population. It is well recognized that many worker populations have lower mortality rates than the general population, because the workers must be healthy to perform their work. This study shows that the radiation-exposed shipyard population falls in this category.

The death rate for cancer and leukemia among the radiation-exposed workers was slightly lower than that for non-radiation-exposed workers and for the general US. population. However, an increased rate of mesothelioma, a type of respiratory system cancer linked to asbestos exposure, was found in both radiation-exposed and non-radiation-exposed shipyard workers, although the number of cases was small reflecting the rarity of this disease in the general population. The researchers suspect that shipyard worker exposure to asbestos in the early years of the NNPP, when the hazards associated with asbestos were not as well understood as they are today, might account for this increase.

In conclusion, the Johns Hopkins study found no evidence to conclude that the health of people involved in work on US. nuclear-powered ships has been adversely affected by exposure to low levels of radiation incidental to this work. Additional studies are planned to investigate the observations and update the study with data beyond 1981.

In 1987, the Yale University School of Medicine completed a study of the health of Navy personnel assigned to nuclear submarine duty between 1969 and 1981 (Ostfeld 1987). This study was sponsored by the US. Navy Bureau of Medicine and Surgery to determine if the enclosed environment of submarines had any impact on the health of these personnel. Although not strictly designed as a cancer study of a low-dose population, the study did examine cancer mortality as a function of radiation exposure. The study concluded that submarine duty had not adversely impacted the health of crew members. Furthermore, there was no correlation between cancer mortality and radiation exposure. These observations were based on comparison of death rates among about 76,000 officers and enlisted submariners (all who served between 1969 and 1981) against an aged-matched peer group. The results of this study were published in the Journal of Occupational Medicine (Charpemtier 1993).

7.0 NUMERICAL ESTIMATES OF RISK FROM RADIATION

One of the major aims of the studies of exposed populations as discussed above is to develop numerical estimates of the risk of radiation exposure. These risk estimates are useful in understanding the hazards of radiation exposure, evaluating and setting radiation protection standards, and helping resolve claims for compensation by exposed individuals.

The development of numerical risk estimates has many uncertainties. As discussed above, excess cancers attributed to radiation exposure can only be observed in populations exposed to high doses and high dose rates. However, the risk estimates are needed for use in evaluating exposures from low doses and low dose rates. Therefore, the risk estimates derived from the high dose studies must be extrapolated to low doses. This extrapolation introduces a major uncertainty. The shape of the curve used to perform this extrapolation becomes a matter of hypothesis (that is, assumption) rather than observation. The inability to observe the shape of this extrapolated curve is a major source of controversy over the appropriate risk estimate.

Scientific committees, such as the National Academy of Science (National Academy of Sciences 1990), UNSCEAR (UNSCEAR 1988), and the NCRPM (NCRPM 1987c) all conclude that accumulation of dose over weeks or months, as opposed to in a single dose, is expected to reduce the risk appreciably. A dose rate effectiveness factor (DREF) is applied as a divisor to the risk estimates at high doses to permit extrapolation to low doses. The National Academy of Sciences (National Academy of Sciences 1990) suggested that a range of DREF's between 2 and 10 may be applicable and reported a best estimate of 4 based on laboratory animal studies. However, despite these conclusions by the scientific committees, some critics argue that the risk actually increases at low doses while others argue that cancer induction is a threshold effect and the risk is zero below the threshold dose. As stated at the beginning of this section, the NNPP has always conservatively assumed radiation exposure, no matter how small, may involve some risk.

In 1972, both the UNSCEAR and the National Academy of Sciences-National Research Council Advisory Committee on the Biological Effects of Ionizing Radiations issued reports that estimated numerical risks for specific types of cancer from radiation exposure to humans (UNSCEAR 1972; National Academy of Sciences 1972). Since then, national and international scientific committees have been periodically re-evaluating and revising these numerical estimates based on the latest data and information. The most recent risk estimates are from the same two committees and are contained in their 1988 and 1990 reports, respectively (UNSCEAR 1988; National Academy of Sciences 1990). In these reports, both committees provided risk estimates that were larger than the risk estimates in their previous reports. This increase in the new estimates was due to the use of new models for projecting the risk into the future, revised dose estimates for survivors of the Hiroshima and Nagasaki atomic bombs, and additional data on the cancer experience by both atomic bomb survivors and persons exposed to radiation for medical purposes. A risk estimate for radiation-induced cancer derived from the most recent analysis (UNSCEAR 1988; National Academy of Sciences 1990), can be briefly summarized as follows:

In a group of 10,000 workers in the U.S., a total of about 2,000 (20 percent) will normally die of cancer. If each of the 10,000 received over his or her career an additional one rem, then an estimated four additional cancer deaths (0.04 percent) might occur. Therefore, the average worker's lifetime risk of cancer has been increased nominally from 20 percent to 20.04 percent.

The above risk estimate was extrapolated from estimates applicable to high doses and dose rates using a DREF of about 2. This estimate probably overstates the true lifetime risk at low doses and dose rates, because a DREF of 2 is at the low end of probable DREF values. The National Academy of Sciences, in assessing the various sources of uncertainty, concluded that the true lifetime risk may be contained within an interval which extends from zero to about a factor of three higher than the above (National Academy of Sciences 1990). The National Academy of Sciences points out that the lower limit of uncertainty extends to zero risk "as the possibility that there may be no risks from exposure comparable to external natural background radiation cannot be ruled out."

8.0 RISK COMPARISONS

For comparison with risks normally associated with everyday life, Table E-l illustrates the chance of death occurring from various sources over an individual's lifetime. The risk associated with radiation from NNPP plants was determined from an individual receiving 1 rem of lifetime accumulated exposure.

Table E-l

Some Commonplace Lifetime Risks (Crouch and Wilson 1982)	*Lifetime Risk[1] (Percent)*
Smoking	12
Motor Vehicle Accidents	12
Home Accidents	0.79
Falls	0.45
Drowning	0.26
Fires	0.20
Accidental Poisoning	0.10
Firearms	0.07
Electrocution	0.04
Radiation exposure associated with Naval nuclear propulsion plants (risk estimate)	0.04

Note: 1. Smoking assumes at risk from 32 to 72 (40 years) and Motor Vehicle Accidents assume at risk from 18 to 72 (54 years). Other risk assume at risk for lifetime (72 years).

9.0 LOW-LEVEL RADIATION CONTROVERSY

In low-level radiation, as in other areas, a very effective way to frighten people is to claim that no one knows what the effects are. This has been repeated so often that it has almost become an article of faith that no one knows the effects of low-level radiation on humans. The critics are able to make this statement because, as discussed above, human studies of low-level radiation exposure are unable to be conclusive as to whether or not an effect exists in the exposed groups, because of the extremely low incidence of an effect. Therefore, assumptions are needed regarding extrapolation from high-dose groups. The reason low dose studies are not able to be conclusive is because the risk, if it exists at these low levels, is too small to be seen in the presence of all the other risks of life. The fact that a controversy exists is evidence that the radiation risk is very small.

The effect of radiation exposures at occupational levels is also extremely small. There are physical limits to how far scientists can go to ascertain precisely the size of this risk, but it is known to be small. Instead of proclaiming how little is known about low-level radiation, it is more appropriate to emphasize how much is known about the small actual effects.

This appendix has been written to give the reader a basic understanding of radiation experienced in everyday life and the extremely small risks associated with exposure to low levels of ionizing radiation. References for citations in this appendix can be found in Volume I, Chapter 13 under the references section for Chapter 7.

APPENDIX F

DETAILED ANALYSES OF NORMAL OPERATIONS AND ACCIDENT CONDITIONS FOR RADIOLOGICAL SUPPORT FACILITIES

APPENDIX F
DETAILED ANALYSES OF NORMAL OPERATIONS AND ACCIDENT CONDITIONS FOR RADIOLOGICAL SUPPORT FACILITIES

1.0 INTRODUCTION

Normal operations and accidents have been evaluated for support facilities to estimate the potential for releases of radioactive material. The results of these analyses are presented in terms of the health effects to facility workers and the public predicted due to the release of radioactive materials into the environment. For perspective, an additional discussion on radiation exposure and risk is provided in Appendix E, and supports the position that these analyses are conservative. Effects on environmental factors are also presented, based on the amount of land that could be impacted due to postulated accidents. The normal operations emission source term for NIMITZ-class aircraft carriers was conservatively estimated based on procedures approved by the EPA for compliance with 40 CFR 61.

Accidents were considered for inclusion in detailed analyses if they were expected to contribute substantially to risk (defined as the product of the probability of occurrence of the accident multiplied by the consequence of the accident). Accidents were categorized into three types: Abnormal Events, Design Basis accidents, or Beyond Design Basis Accidents. These categories are characterized by their probability of occurrence as described further in section 2.6 of this appendix. Construction and industrial accidents are included in these categories. Two hypothetical accidents were analyzed at each location using area specific data. The first scenario is a fire in a radiological support facility that spreads to radioactive material resulting in an airborne release of radioactivity. The second scenario is a spill into surrounding waters of radioactive liquid from a collection facility. References for citations in this appendix can be found in Volume I, Chapter 13 under the references section for Chapter 7.

1.1 USE OF SCIENTIFIC NOTATION

Much of the data in this appendix is presented using scientific notation. Scientific notation consists of a number multiplied by the appropriate power of 10 and is commonly used to represent very large or small numbers. For example, 0.0000035 would be represented as 3.5×10^{-6} and 3,500,000 would be represented as 3.5×10^{6}.

12 NORMAL OPERATION

Table F-l presents the annual risk of latent fatal cancer to a member of the general population living within a 50-mile radius of each site and for the maximally exposed off-site individual due to radiological releases from normal operations. The normal incidence of cancer for a typical population has been included for comparison. The results in this table were calculated using the methods described in section 2.0 of this appendix. The radiation exposures to the general public would be so small at each of the home port locations that they would be indistinguishable from naturally occurring background radiation. The results show that the annual individual risk of a latent fatal cancer occurring in the general population within 50 miles of a NIMITZ-class aircraft carrier home port is very low at each of the home port locations evaluated, less than one chance in

Table F-l. Annual Risk of Latent Fatal Cancer from Normal Operations

Possible Home Port Location	*Average Annual Risk of Latent Fatal Cancer to a Member of the General Population from Normal Operation*	*Individual Annual Risk of Latent Fatal Cancer to the Maximally Exposed Of-Site Individual from Normal Operation*	*An Individual's Annual Risk of Dying From all Cancers*
NASNI	1 in 2 billion (4.8×10^{-10})	1 in 19 million (5.1×10^{-8})	1 in 360 (2.8×10^{-3})
Puget Sound Naval Shipyard (PSNS)	1 in 14 billion (6.9×10^{-11})	1 in 7 million (1.4×10^{-7})	1 in 360 (2.8×10^{-3})
Pearl Harbor Naval Shipyard (PHNSY)	1 in 4 billion (2.5×10^{-10})	1 in 45 million (2.2×10^{-8})	1 in 360 (2.8×10^{-3})
Naval Station (NAVSTA) Everett	1 in 9 billion (1.1×10^{-10})	1 in 3 million (33×10^{-7})	1 in 360 (2.8×10^{-3})

2 billion. See section 3.1 of this appendix for more information on calculation of risks from normal operation.

1.3 HYPOTHETICAL ACCIDENTS AT SUPPORT FACILITIES

Two hypothetical radiological support facility accidents were analyzed at each location using the methods described in section 2.0 of this appendix. Risk is defined as the product of the consequences of an event multiplied by the probability of that event. The risks associated with the accidents analyzed have not been added together. The risks presented in this section result from extremely conservative analyses and more refined analyses would not be expected to result in increases in calculated risk.

The accident that results in the highest risk is a fire in the radiological support facility that involves radioactive materials. As was the case for the normal operations evaluation, the accident risk is very low.

Table F-2 presents a summary of the risk of fatal cancers for a hypothetical fire at a radiological support facility, a hypothetical release of liquid containing low-level radioactivity, and for comparison, the risk of fatal cancers from all sources in a typical population. Consistent with the detailed tables, this summary table shows that the annual individual radiological risks to a member of the general population due to accidents associated with support facilities for homeporting of NIMITZ-class aircraft carriers are very low at all of the locations evaluated, less than one chance in 580 million. See section 3.2 of this appendix for more information on calculation of risks associated with hypothetical accidents at support facilities.

Table F-2. Annual Risk of Latent Fatal Cancer from Radiological Support Facility Accidents

Possible Home Port Location	*Average Annual Risk of Latent Fatal Cancer to a Member of the General Population from a Radiological Support Facility Fire, Including Probability of Fire Occurring*	*Individual Annual Risk of Latent Fatal Cancer to the Maximally Exposed Of-Site Individual from a Radiological Support Facility Fire, Including Probability of a Fire Occurring*	*Average Annual Risk of Latent Fatal Cancer to a Member of the General Population from a Radiological Support Facility Spill, Including Probability of Spill Occurring*	*Individual Annual Risk of Latent Fatal Cancer to the Maximally Exposed Off-Site Individual from a Radiological Support Facility Fire, Including Probability of a Spill Occurring*	*An Individual's Annual Risk of Dying from all Cancers*
NASNI	1 in 700 million (1.4×10^{-9})	1 in 2 million (5.0×10^{-7})	1 in 38.5 billion (2.6×10^{-11})	1 in 360 million (2.8×10^{-9})	1 in 360 (2.8×10^{-3})
PSNS	1 in 3.5 billion (2.9×10^{-10})	1 in 833,000 (1.2×10^{-6})	1 in 227 billion (4.4×10^{-12})	1 in 2 billion (4.8×10^{-10})	1 in 360 (2.8×10^{-3})
PHNSY	1 in 580 million (1.7×10^{-9})	1 in 2 million (4.4×10^{-7})	1 in 227 billion (4.4×10^{-12})	1 in 2 billion (4.8×10^{-10})	1 in 360 (2.8×10^{-3})
NAVSTA Everett *	1 in 1.7 billion (6×10^{-10})	1 in 470,000 (2.2×10^{-6})	1 in 232 billion (4.3×10^{-12})	1 in 2 billion (4.8×10^{-10})	1 in 360 (2.8×10^{-3})

* No Radiological Support Facility at NAVSTA Everett.

1.4 RADIOLOGICAL IMPACT ON ENVIRONS

The radiological impact of accidents on the environs of each location was determined by examining the area that could be contaminated following such an event. Calculations using average meteorological conditions were performed for each accident scenario to determine the area that could be contaminated (note that 95 percent worst-case meteorology was used when calculating exposure and risk to workers and the general population). These calculations determined the extent of the contamination that causes only a small increase in background radiation from naturally occurring sources. For the fire accident analyzed, the contaminated area was confined to the boundaries of the base or shipyard. The impact of this contamination would be temporary while the area was isolated and remediation efforts completed, although, as pointed out previously and discussed further below, the analysis of the accident presented in this EIS makes the conservative assumption that no isolation or removal occurs.

For the release of a radioactive liquid accident, a footprint was not calculated due to the immediate dilution of the radioactive material that occurs in the water. Only the support facility fire analysis was evaluated to determine if the radiological impacts would be confined to the boundaries of the base or shipyard.

The conclusion that there are no significant radiological impacts associated with homeporting carriers in any of the locations evaluated is based on the Navy's historical record of safe operation of nuclear-powered warships and a comprehensive environmental monitoring program performed by the Navy and corroborated by independent monitoring that has been in place for decades. These are discussed in detail in Chapter 7.0 of the EIS.

The EIS analyses were prepared using methodology that is consistent with other federal agencies' guidance for preparing NEPA documentation involving radiological analyses (see section 6.2 of U.S. Department of Energy, Office of NEPA Oversight, Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements, May 1993). The incidence of fatal cancer was evaluated using International Commission on Radiological Protection (ICRP) methodology (ICRP 1991), which is also consistent with the methodology set forth in the National Academy of Sciences Biological Effects of Ionizing Radiation Report (National Academy of Sciences 1990). The report states "the possibility that there may be no risks from exposures comparable to natural background radiation cannot be ruled out. As such low doses and dose rates, it must be acknowledged that the lower limit of the range of uncertainty in the risk estimates extends to zero." For very small doses, the ICRP assumes no threshold exists below which exposure fails to cause a health effect, and it assumes a linear response throughout the exposure range.

1.5 CALCULATION OF RISK AND CONSEQUENCE

The topics of human health effects caused by radiation and the risks associated with normal operations or postulated accidents are discussed several times throughout this EIS. It is important to understand these concepts and how they are used in order to understand the information presented in this document. It is also valuable to have some frame of reference or comparison for understanding how the risks compare to the risks of daily life.

The method used to calculate the risk of any impact is fundamental to all of the evaluations presented and follows standard accepted practices. The first step is to determine the probability that a specific event will occur. For example, the probability that a routine task, such as operating a crane, will be performed sometime during a year of normal operations at a facility would be 1.0. That means that the action would certainly occur. The probability that an accident might occur is less than 1.0. This is true because accidents occur only occasionally and some of the more severe accidents, such as a catastrophic earthquake, might occur at any location only once in hundreds, thousands, or millions of years.

Once the probability of an event has been determined, the next step is to predict what the consequences of the event being considered might be. One important measure of consequences chosen for this EIS is the number of human fatalities from cancer induced by radiation. This was chosen because this document deals with radioactive materials. The number of cancer fatalities that might be caused by any routine operation or any postulated accident can be calculated using a standard technique based on the amount of radiation exposure that might occur from all conceivable pathways and the number of people who might be affected (refer to section 2.2 of this appendix).

A couple of examples should serve to illustrate the calculation of risk. In the first, the lifetime risk of dying in a motor vehicle accident can be computed from the likelihood of an individual being in an automobile accident and the consequences or number of fatalities per accident. There were 10,000,000 motor vehicle accidents during 1992 in the United States resulting in about 40,000 deaths (NSC 1993). Thus, the probability of a person being in an automobile accident is 10,000,000 accidents divided by approximately 250,000,000 persons in the United States, or 0.04 per year. The number of fatalities per accident, 0.004 (40,000 deaths divided by 10,000,000 accidents), is less than 1 since many accidents do not cause fatalities. Multiplying the probability of the accident (0.04 per year) by the consequences of the accident (0.004 deaths per accident) by the number of years the person is exposed to the risk (72 years is considered to be an average lifetime) gives the risk for any individual being killed in an automobile accident. From this calculation, the overall risk of someone dying in a motor vehicle accident is about one chance in 87 over their lifetime.

A second example illustrates the calculation of risk for another event that occurs daily. Fossil fuels, such as natural gas or coal, contain naturally occurring radioactive material that is released into the air during combustion. This radioactivity in the air finds its way into our bodies through the food we eat and the air we breathe. This radioactivity has been estimated to produce about 0.5 millirem of radiation dose to the average American each year (NCRPM 1987a). The probability of this happening is essentially 1.0 since these fuels are burned every day all over the country. The number of fatal cancers from exposure to 0.5 millirem per year is calculated by taking 0.5 millirem per year multiplied by the 72 years considered to be an average lifetime multiplied by the 0.0005 fatal cancers estimated to be caused by each rem (0.5 millirem per year x 72 years x 0.0005 fatal cancers per rem = 0.000018 fatal cancers per individual lifetime). The risk is the probability (1.0) times the consequences (0.000018 cancer fatalities), which equals about one chance in 55,000 of death from this cause over a lifetime.

These risks and others from everyday life can be used to gain a perspective on the risks associated in this EIS. As a further comparison, the naturally occurring radioactive materials in agricultural fertilizer contribute about 1 to 2 millirem per year to an average American's exposure to radiation (NCRPM 1987a). A calculation similar to the one in the preceding paragraph shows that the use of fertilizer to produce food crops in the United States results in a risk of death from cancer between one chance in 12,500 and one chance in 25,000. Finally, the average American's risk of dying from cancer from all causes is one chance in 5 over his or her entire lifetime. These risks can be compared, for example, to the average individual risk of less than one chance in 28 million for a resident in the vicinity of any of the home port locations of developing a fatal cancer over that person's entire lifetime due to normal operations and support of NIMITZ-class aircraft carriers.

A frame of reference for the risks from accidents associated with NIMITZ-class aircraft carrier operations and support can be developed in the same way. For example, for an average resident in the vicinity of Naval Air Station North Island (NASNI), the individual risk of death from cancer over a person's entire lifetime caused by a radioactive material fire in the support facility would be approximately one chance in 9 million. This individual risk was determined by dividing the risk value to the population within 50 miles (3.5×10^{-3}) by the population total of 2,481,069 and multiplying by an average life span of 72 years. This risk can be compared to the risks of death from other accidental causes to gain a perspective. For example, the risk of death in a motor vehicle accident was calculated earlier to be about one chance in 87. Similarly, the risk of death for the average American from fires is approximately one chance in 500, and for death from accidental poisoning the risk is about one chance in 1,000 (Crouch and Wilson 1982).

2.0 PATHWAYS ANALYSIS

Accidents were considered for inclusion in detailed analyses if they were expected to contribute substantially to risk (defined as the product of the probability of occurrence of the accident multiplied by the consequence of the accident). The pathways whereby members of the public can be affected from radiological support facility operations are direct exposure to radiation, inhalation of radioactive materials, or ingestion of radioactive materials. Recognizing these fundamental processes and pathways, two hypothetical accidents were postulated, each resulting in a release of 1 Curie of cobalt 60 and the associated proportioned amounts of other radioactive elements expected.

The first scenario is a fire in a radiological support facility that spreads to radioactive material resulting in an airborne release of radioactivity. The amount of radioactivity released during this accident scenario was conservatively established at 1 Curie of cobalt 60 and the associated proportioned amounts of other radioactive elements expected, which represents a conservative amount of radioactivity as compared to the typical amount that might accumulate within a support facility due to normal operations. For the analysis, several conservative assumptions were used as follows:

- The meteorological conditions are considered to be 95 percent worst case (with no credit given that the likelihood of these conditions is only one chance in 20).
- No evacuation of the public or cleanup of contaminated areas is assumed.
- No cleanup of the contaminated area is assumed to occur.

Note that these assumptions are conservative since radioactive material storage facilities are specifically constructed to inhibit the spread of fire and have automatic sprinkler systems installed. Moreover, emergency response measures include provisions for immediate response to any emergency, identification of the accident conditions, and communications with state and local authorities.

The second scenario is a spill into surrounding waters of radioactive liquid from a collection facility. The released radioactivity is evaluated for transfer from the location of release to the general public through tidal movements, ingestion by fish and crustaceans, and possible release into area aquifers with subsequent contamination of wells and water supplies. The amount of water release was assumed to contain 1 Curie of cobalt 60 and the associated proportioned amounts of other radioactive elements expected. These assumptions are conservative since it would require a spill of over 26 million gallons of radioactive liquid (discharged primary coolant) at levels normally contained in collection facilities, which are tanks no larger than 10,000 gallons. Furthermore, the total capacity to store radioactive liquid at support facilities typically would be less than 100,000 gallons.

Examining the kinds of accidents that could result in release of radioactive material to the environment or an increase in radiation levels shows that they can only occur if an accident produces severe conditions. Some types of accidents, such as procedure violations, spills of small volumes of water containing radioactive particles, or most other types of common human error, may occur more frequently than the more severe accidents analyzed. However, they involve minute amounts of radioactive material and thus are insignificant relative to the accidents evaluated. Stated another way, the very low consequences associated with these events produce smaller risks than those for the accidents analyzed, even when combined with a higher probability of occurrence. Consequently, they have not been evaluated in greater detail in this EIS. Acts of terrorism are expected to result in consequences that are bounded by the results of accidents that were evaluated.

The EIS analyses were performed to in such a way that the estimates provided are unlikely to be exceeded during either normal operations or in the event of an accident. Even using these **conservative** analytical methods, the risks (defined as the consequences of an event times the probability of occurrence) for all the alternatives are very small and support the conclusion that there is no significant radiological impacts associated with homeporting CVNs at any of the home port locations evaluated.

2.1 CALCULATION OF RADIATION EXPOSURES

An evaluation of normal operations and hypothetical accidents for a radiological support facility at each location was performed to assess the possible radiation exposure to individuals due to the release of radioactive materials.

Radiation exposure to the different individuals and the general population is calculated for normal operations and for accident conditions as follows:

- Worker (Worker) — An individual located 100 meters (330 feet) from the radioactive material release point.
- Maximally exposed off-site individual (MOI) — A theoretical individual living at the Naval base or shipyard boundary receiving the maximum exposure. No evacuation of this individual is assumed to occur.
- Nearest public access individual (NPA) — Military personnel, civilian employees, or their family members, including some who reside on the base, may be located outside the controlled industrial area boundary but inside the confines of the military base or shipyard. Such people may be in their homes, buildings, or on the roadways of the base at the time of an accident or at any time throughout the year for the evaluation of normal operations. The base residents are used as the NPA individuals for analyses of normal operations. In **the event of an accident, they would be evacuated within 2 hours** under military control of **the base, so this time was used in accident calculations.**
- General U.S. population within a 50-mile **radius** of the facility — Consistent with the requirements of NEPA, the results presented in the following tables identify the potential radiological impacts to the United States territories and population. However, due to the proximity of the Mexican border (approximately 12 miles) to the radiological support facility at NASNI, a conservative analysis has **been** completed to bound the potential radiological impacts to the surrounding Mexican population. The results of this analysis are briefly described in the sections that follow.

Exposure is calculated to result from direct radiation from the facility and exposure to radioactive contamination released to the air and water. *Normal* releases directly to the water pathway occur because support facilities are located directly on bodies of water, and contamination of the water results from fallout of airborne contamination. **The releases to the air and water might result in** exposure through several pathways, described as follows:

- External direct exposure from immersion in the airborne radioactive material (air immersion).
- External direct exposure from radioactive material deposited on the ground (ground surface).
- Internal exposure from inhalation of radioactive aerosols and suspended particles (inhalation).
- Internal exposure from ingestion of terrestrial food and animal products (ingestion).
- Exposure from and ingestion of contaminated water.

The radiation exposure is calculated by the computer programs, discussed in section 2.5 of this appendix, in a manner recommended by the ICRP (ICRP 1977, 1979). Weighting factors are used for various body organs to calculate a committed effective dose equivalent (CEDE) from radiation inside the body due to inhalation or ingestion. Committed dose equivalents (CDEs) are calculated for organs such as the lungs, stomach, small intestine, upper large intestine, lower large intestine, bone surface red bone marrow, testes, ovaries, muscle, thyroid, bladder, kidneys, liver, etc. The CEDE value is the summation of the CDEs to the specific organ weighted by the relative risk to that organ compared to an equivalent whole-body exposure.

The-programs also calculate an effective dose equivalent (EDE) for the external exposure pathways (immersion in the radioactive material, exposure to ground contamination) and a 50-year CEDE for the internal exposure pathways. The sum of the EDE from external pathways and the CEDE from internal pathways is called the total effective dose equivalent (TEDE) and is also calculated by the programs. The TEDE reported in the results section is the sum of the TEDEs from air, water, and direct radiation exposures.

The exposure from ingestion of terrestrial food, animal products, and drinking water is calculated on a yearly basis. However, it is expected that continued consumption of contaminated food products and water by the public would be suspended after a Protective Action Guideline is reached. In 1991, the Environmental Protection Agency recommended protective action guidelines in the range of 1 to 5 rem whole-body exposure. To ensure a consistent analysis basis, no reduction of exposure due to a Protective Action Guideline was accounted for in the analysis. This would result in a conservative approach that may slightly overestimate health effects within an exposed population, but allows for consistent comparisons.

2.2 CALCULATION OF HEALTH EFFECTS

Health effects are calculated from the exposure results. The risk factors used for calculations of health effects are taken from Publication 60 of the ICRP (ICRP 1991). Table F-3 lists the

Table F-3. Risk Estimators for Health Effects from Ionizing Radiation			
		RISK FACTOR (PROBABILITY PER REM)*	
Effect	*Nuclide*	*Worker*	*General Population*
Fatal cancer (all organs)	All	4.0×10^{-4} (1 in 2,500)	5.0×10^{-4} (1 in 2,000)
Weighted non-fatal cancer**	All	8.0×10^{-5} (1 in 12,500)	1.0×10^{-4} (1 in 10,000)
Weighted genetic effects**	All .	8.0×10^{-5} (1 in 12300)	1.3×10^{-4} (1 in 7,692)
Weighted total effects**	All	5.6×10^{-4} (1 in 1,786)	7.3×10^{-4} (1 in 1,370)

Notes: • For high individual exposures (20 rem), the above risk factors are multiplied by a factor of two. General population exposures were not modified because the large drop in exposure with increasing distances results in average exposure rates well below 20 rem.
** In determining a means of assessing health effects from radiation exposure, the ICRP has developed a weighting method for non-fatal cancers and genetic effects to obtain a total weighted effect, or "health detriment".

appropriate factors used in the analysis of both the normal operations and the hypothetical accident scenarios. Risk factors are higher for the general population because it includes children. Total health effects to the general population (deaths, non-fatal cancers, genetic effects, and other impacts on human health) may be easily obtained by multiplying latent cancer fatalities by the factor of 1.46.

Since all of the analyses in this Appendix present the consequences in terms of radiation exposure (rem), the health effect of interest can be determined by multiplying the radiation exposure by the risk factor of interest from Table F-3. For example, the number of people in the general population expected to develop a non-fatal cancer as a result of a hypothetical support facility fire at NASNI can be calculated by obtaining the exposure from Table F-9 (1,400 rem) and multiplying it by the risk factor from Table F-3 (1.0×10^{-4}) to get 1.4×10^{-1} or 0.14. Similar calculations can be completed for other accidents or health effects of interest.

Table F-4. Population Estimates	
Possible Home Port Location	*Estimated Number of People within a 50-Mile Radius*
NASNI	2,481,069
PSNS	2,975,810
PHNSY	817385
NAVSTA Everett	2,328,554

2.3 POPULATION DISTRIBUTION

Population distributions specific to each location were used for the evaluations, and are shown in Table F-4. The population distributions were obtained from 1990 United States Census data. The population information was obtained in 16 compass directions and five equal radial distances from the support facility location to a 50-mile total distance.

2.4 METEOROLOGY

Meteorological data used in the analyses were obtained from the Support Center for Regulatory Air Models (SCRAM) bulletin board system. The bulletin board is operated by the SCRAM within the Environmental Protection Agency, Office of Air Quality Planning and Standards. The SCRAM surface meteorological data files are comprised of data acquired from the National Climatic Data Center. The SCRAM data for 5 years were used with programs from the bulletin board to develop meteorological data in the STability ARray (STAR) format, which is a joint frequency distribution of six wind speed intervals, 16 wind directions, and six stability categories. The STAR data were reformatted into the format required by the GENII program, described below, for evaluation of normal operations.

The STAR data were used to calculate the 95 percent meteorological conditions for the accident analyses. The 95 percent condition represents the meteorological conditions that could produce the highest calculated exposures. This is defined as that condition that is not exceeded more than 5 percent of the time or is the worst combination of weather stability class and wind speed. Each of these conditions is evaluated for 16 wind directions.

SCRAM data for the years 1988 through 1992 was used in this evaluation for all home port locations. For NASNI the data was obtained from the San Diego Airport, for PSNS and NAVSTA Everett the data was obtained from the Seattle-Tacoma Airport, and for Pearl Harbor Naval Base the data was obtained from the Honolulu Airport.

2.5 COMPUTER PROGRAMS

Five computer programs were used to evaluate the radiation exposures to the specified individuals and general population.

GENII

The code used for the environmental transport and exposure assessment calculations for normal operations was GENII (Napier 1988). This code was developed at Pacific Northwest National Laboratory by Battelle Memorial Institute to incorporate the internal dosimetry models recommended by the ICRP in Publication 26 (ICRP 1977) and Publication 30 (ICRP 1979) into environmental pathway analysis models in use at Pacific Northwest National Laboratory.

Although GENII can be used to model both acute and chronic releases to the atmosphere, only the chronic option was used in the normal operations evaluation reflecting long-term average exposure to the released radioactive contaminants. For the chronic evaluations, the code also uses meteorological conditions averaged over each sector to reflect exposure to long-term average concentrations. The ingestion calculation used the modeling approach that exposed individuals within 50 miles of the site consumed 30 percent of milk products and 10 percent of all products grown locally where the people live.

RSAC-5

The computer code RSAC-5 was developed by Westinghouse Idaho Nuclear Co, Inc., for the DOE-ID Operations Office and is in the public domain (Wenzel 1994). The code calculates the consequences of the release of radionuclides to the atmosphere. It allows the amount of each nuclide from a nuclear event to be input individually or to be calculated internally by the code. RSAC-5 calculates potential radiation exposures to maximally exposed individuals or population groups via inhalation, ingestion, exposure to radionuchdes deposited on the ground surface, immersion in airborne radioactive material, and radiation from a cloud of radioactive material RSAC-5 meteorological capabilities include Gaussian plume dispersion for Pasquill-Gifford conditions. RSAC-5 release scenario modeling allows reduction of nuclides by chemical group or element and calculates decay and buildup during transport through operations, facilities, and the environment. It also models the effect of filters or other cleanup systems. Population exposures are the product of the calculated individual exposure and the number of people in the affected population.

ORIGEN

ORIGEN (Croff 1980) is a computer code system for calculating the buildup and decay of radioactive materials (fission products, actinides, and activation products).

SPAN

SPAN (Wallace 1972) is the computer code that was used to calculate the direct radiation levels. Attenuation from air was included in the calculated radiation levels. To determine the unit person exposure per sector, SPAN was used to integrate the radiation level over the sector. The radiation levels calculated at various distances were used as the source to represent the proper distance falloff in the sector, and a total radiation level for each sector was calculated. This total integrated radiation level for each sector was then divided by the sector volume, resulting in an "average" radiation exposure for any point within the sector.

WATER RELEASE

WATER RELEASE is an unpublished computer code used to calculate exposures to humans arising from radionuclides that have been introduced into water in the vicinity of the radiological support facilities. The following discussion provides a brief description of the key points associated with obtaining these estimates. All radionuclides that were considered to be introduced into the water at a site were postulated to be promptly distributed uniformly in the water in the immediate vicinity of the site during the period in which the nuclides were introduced.

There are two processes by which radionuclides might enter the water: via liquid discharge or via airborne discharge. For liquid discharges, a fraction of the released radionuclides might enter the water accessed by humans each year by infiltrating the ground to the groundwater then traveling either to wells or surface water. For airborne discharges, some fraction of the released radionuclides might enter the water by deposition from the air. For both of these processes, the fraction of radionuclides that might enter the water used by humans has been postulated to enter the water immediately.

Once the radionuclides have been introduced into the water at a site, they were calculated to be transported to locations where they might affect man either directly as via immersion (swimming) or indirectly as via ingestion of food. During this transport period, these radionuclides are subjected to various mechanisms that may reduce their concentration in the water, such as radioactive decay, dilution in larger volumes of water, removal by sedimentation, etc. The pathways considered in this analysis by which radionuclides in the water at a site might reach man are immersion, exposure to surface deposits, boating and equipment exposure, and consumption of drinking water, fish, crustaceans, molluscs, game animals, vegetables and fruits, root crops, milk and eggs, and domesticated animals. During the period when the radionuclides have left the water environment and are being transported through the pathways to man, they may be subjected to both concentration and removal mechanisms that would further modify their effect on humans. These mechanisms include concentration in the surface deposit, animal, and crop pathways; decay during periods between harvesting a crop and its ingestion by people; and removal of activity due to harvesting, handling, and cleaning of a foodstuff.

Estimates were made for the exposures that the total population affected by releases from the site may receive and for the exposures that a maximally exposed individual may receive from these same releases. The exposures to the population affected at a given site were obtained by calculating the exposures received by an average individual in the vicinity of that site and multiplying that exposure by the number of people that are affected. The exposure to a maximally exposed individual used the maximum exposures and consumption rates that any individual at that site may experience regardless of the probabilities associated with just one individual actually following all the maximum pathways. The specific pathways that are applicable at a given site are dependent upon the site, since the exposure of an average or a maximum individual to each of the pathways is different for each of the sites. The total exposure to the population or to a maximally exposed individual at a given site is the resultant sum of the exposure commitments from the individual pathways applicable at that site.

2.6 ACCIDENT CATEGORIZATION AND PROBABILITY OF OCCURRENCE

Abnormal Events

Abnormal events are unplanned or improper events that result in little or no consequence. Abnormal events include industrial accidents and accidents during normal operations such as skin contamination with radioactive materials, spills of radioactive liquids, or exposure to direct radiation due to improper placement of shielding. The occurrence of these unplanned events has been anticipated and mitigative procedures are in place that promptly detect and eliminate the events and limit the effects of these events on individuals. As a result, there is little hazard to the general population from these events. Such events are considered to occur in the probability range of 1 to 10^{-3} per year. The probability referred to here is the total probability of occurrence and includes the probability the event occurs (e.g., fire) times other probabilities required for the consequences.

Design Basis Accident Range

Accidents that have a probability of occurrence in the range of 10^{-3} to 10^{-6} per year are included in the range called the Design Basis Accident Range. The terminology "design basis accident," which normally refers to facilities to be constructed, also includes the "evaluation basis accident," which applies to existing facilities. For accidents included in this range, results are presented for the 95-percent meteorological condition. Risk calculations for accidents in this range utilize the consequences associated with 95-percent meteorological conditions.

Beyond Design Basis Accidents

This range includes accidents that are less likely to occur than the design basis accidents but that may have very large or catastrophic consequences. Accidents included in this range typically have a total probability of occurrence in the range of 10^{-6} to 10^{-7} per year. Accidents that are less likely than 10^{-7} per year typically are not discussed since it is expected they do not contribute in any substantial way to the risk (see section 6.4 of U.S. Department of Energy, Office of NEPA Oversight, Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements, May 1993).

2.7 DETERMINATION AND EVALUATION OF IMPACTED AREA

The impacted area surrounding a facility following an accident was determined for the fire accident scenario. The impacted area was defined as that area in which the plume deposited radioactive material to such a degree that an individual standing on the boundary of the fallout area would receive approximately 0.01 mrem/hr of exposure. If this individual spends 24 hours a day at this location, that person would receive about 88 mrem per year from the ground surface shine. This is within the 100 mrem/year limit of 10 CFR 20 for NRC-licensed reactor facilities.

To best characterize the affected areas for each casualty, a typical 50-percent meteorology (Pasquill-Gifford Class D, wind speed 10 mph) was chosen (note that 95-percent worst-case meteorology was used when calculating exposure and risk to workers and the general population). The RSAC-5 results for ground surface dose were interpolated to determine the distance downwind where the centerline dose had dropped to approximately 88 mrem per year based on 24-hours-per-day exposure. For the wind class chosen, the plume remains within a single 22.5-degree sector. The area affected by the plume is determined as the entire sector contaminated to the calculated downwind distance. This area (footprint) was determined to be 0.14 mile in length and cover an area of approximately 3 acres.

Although the plume would be contained within a single sector, the direction of the wind is unknown. Therefore, the site was examined for impacts in all directions around each facility site out to a distance equal to the footprint length. The contaminated footprint is contained within the facility boundary for all locations evaluated. Since the accidents do occur over a short time, the acreage of the sector quoted is still an accurate indication of the total contaminated area. For the release of radioactive liquid accident, a footprint was not calculated due to the immediate dilution of the radioactive material that occurs in the water.

Secondary impacts of support facility accidents were also evaluated. Access to some areas may be temporarily restricted until cleanup is completed. The water used for drinking and industrial purposes is monitored and use may be temporarily suspended during cleanup operations. In addition, some recreational activities may also be temporarily suspended; however, no enduring impacts are expected. Naval vessels at the base or shipyard could be temporarily contaminated during an accident. Cleanup operations would restore these ships to full readiness. A small number of individuals may experience temporary job loss due to temporary restrictions on farming, fishing, and other support activities near the facility during cleanup operations. Some costs would also be incurred for the actual cleanup operations. Plants and animals on and around the site would experience no long-term impacts. A support facility accident would not result in the extermination of any species nor would it effect the long-term potential for survival of any species. There would be no enduring impacts on treaty rights due to a radiological support facility accident.

2.8 RADIATION EXPOSURE TIME

For members of the general public residing at the site boundary or beyond, no credit is taken for

Table F-5. Estimated Time an Individual Might be Exposed

	Worker (100 m)	*Nearest Public Access (NPA)*	*Individual at Nearest Site Boundary (MOI)*
To Plume	5 min.	100 percent of release time up to 120 min.	100 percent of release time
To Fallout on Ground Surface	20 min.	120 min.	0.7 yr
To Food	None	None	1 yr

any preventive or mitigative actions that would limit their exposure. These individuals are calculated as being exposed to the entire contaminated plume as it travels downwind from the accident site (see Table F-5). Similarly no action is taken to prevent these people from continuing their normal day-today routine, and ingestion of terrestrial food, animal products, and drinking water continue on a yearly basis. The public is assumed to spend approximately 30 percent of the day within their homes or other buildings and the exposure to ground surface radiation is therefore reduced appropriately on a yearly basis.

Individuals that reside or work on site would be evacuated from the affected area within 2 hours (see Table F-5). This is based on the availability of security personnel to oversee the removal of residents, workers, and visitors in a safe and efficient manner. Periodic training and evaluation of the security personnel is conducted to ensure that correct actions are taken during an actual casualty. Therefore, residents, workers, and visitors would be exposed to the entire contaminated plume on site as it travels downwind for a period not to exceed 2 hours. Similarly, the radiation shine from the deposited radioactive materials would be limited to 2 hours. No ingestion of contamination is calculated for these individuals during that 2 hours.

Facility workers all undergo training to take quick, decisive action during a casualty. These individuals quickly evacuate the area and move to previously defined "relocation" areas on the facility site. Workers could be exposed to a full 5 minutes of the radioactive plume as they move to the relocation centers. Once the immediate threat of the plume has moved off site and downwind, the workers would be instructed to walk to vehicles waiting to evacuate them from the site. An additional 15 minutes would be required to evacuate the workers from the contaminated area and therefore the workers receive a total of 20 minutes of ground shine. No ingestion of contamination is calculated for these individuals during that time.

The following summary provides the individual exposure times utilized in the accident analyses presented in section 3 of this appendix.

3.0 RESULTS FROM PATHWAYS ANALYSIS

3.1 NORMAL OPERATION

The purpose of this analysis is to determine the hypothetical health effects on workers and the public due to routine operations. Radioactive releases involved in routine support of ships at the base are small. Airborne emissions of Atomic Energy Act radionuclides are regulated by the EPA or states under the Clean Air Act pursuant to 40 CFR 61 Subpart I. Recently, the Naval Nuclear Propulsion Program (NNPP) performed testing to establish more precisely airborne releases of Atomic Energy Act radioactivity from selected NNPP activities, and submitted that information to EPA. Those evaluations, completed in December 1995, reaffirmed that the total emissions of radioactivity from NNPP activities meet the EPA standards by a factor of 10 to 100. The EPA accepted the NNPP evaluation by letter dated October 1, 1997. The results of the NNPP evaluation, which were the basis for establishing compliance with the standards in 40 CFR 61, are also the basis for the emission estimates listed in this section. Site-specific meteorological and population data were used at each of the locations analyzed. For normal operations, the radiation dose evaluation addresses workers, the maximally exposed off-site individual, the general population, and the nearest public access (NPA) individual. The NPA individual is one living on the base in military housing. Health risks to the general population are presented in two ways. First, the annual risk of a single latent cancer fatality occurring in the entire population within 50 miles of the facility is listed. Then the average individual risk is presented, which is calculated by dividing the annual risk value by the number of people living within 50 miles of the facility.

The radioactive material release source term for the analysis was conservatively estimated for NIMITZ-class aircraft carriers based on procedures approved by the EPA for compliance with 40 CFR 61. The carbon-14 (C-14) source term for each homeporting site is based on the maximum number of NIMITZ-class aircraft carriers added to each site by this EIS. C-14 is the dominant contributor and causes approximately 98 percent of the radiation dose to the general public. The remaining nuclide source term is conservatively based on conditions at a large Naval shipyard performing maintenance and nuclear refueling work. The amount of maintenance performed at the shipyard is significantly higher than would be expected at a home port support facility, therefore the estimate is conservative for evaluation of homeporting NIMITZ-class aircraft carriers. The following radioactive nuclides were used for evaluation at each of the locations analyzed. The release is assumed to occur at 1 meter.

Radionuclide	Puget, Everett, and Pearl Release (Curies/year)	North Island Release (Curies/year)
H-3	1.0	1.0
C-14	2.2	4.4
KR-83M	1.1×10^{-2}	1.1×10^{-2}
KR-85	2.3×10^{-5}	2.3×10^{-5}
KR-85M	2.7×10^{-2}	2.7×10^{-2}
KR-87	3.5×10^{-2}	3.5×10^{-2}
KR-88	5.5×10^{-2}	5.5×10^{-2}
XE-131M	1.5×10^{-3}	1.5×10^{-3}
XE-133M	1.2×10^{-2}	1.2×10^{-2}
XE-133	3.0×10^{-1}	3.0×10^{-1}
XE-135	3.3×10^{-1}	3.3×10^{-1}
AR-41	3.3	3.3
CO-60	1.9×10^{-4}	1.9×10^{-4}
I-131	5.0×10^{-6}	5.0×10^{-6}
I-132	5.4×10^{-6}	5.4×10^{-6}
I-133	1.4×10^{-5}	1.4×10^{-5}
I-135	9.7×10^{-6}	9.7×10^{-6}

Table F-6 summarizes the public health risk to the general population that might result from normal operation. Table F-7 contains the detailed analysis results from normal operations as discussed in section 3.1 of this appendix.

The radiation exposures to the individuals and to the general population living within 50 miles of each of the home port locations evaluated would be so small that they would be indistinguishable from naturally occurring background radiation. The results show that the annual individual risk of a latent fatal cancer from normal operations occurring in the general population within 50 miles of a NIMITZ-class aircraft carrier home port is very low at each of the home port locations evaluated, less than one chance in 2 billion.

The annual risk of a single latent cancer fatality from normal operations occurring in the entire Mexican population within 50 miles of the NASNI facility is 4.1×10^{-4}. This analysis conservatively assumed that the entire population was located in an area of Mexico closest to the facility.

3.2 HYPOTHETICAL ACCIDENTS AT SUPPORT FACILITIES

The analysis of airborne releases from hypothetical accidents is evaluated with RSAC-5 and WATER RELEASE. Unless stated otherwise, the following conditions were used when performing calculations with RSAC-5. In most cases, these conditions are taken directly as defaults from the code.

Wind speed, direction, and Pasquill stability are taken from 95 percent meteorology. See section 2.4 of this appendix for a discussion of meteorological conditions.

- The release is calculated as occurring at ground level (0 m).

- Mixing layer height is 400 meters (1320 feet). Airborne materials freely diffuse in the atmosphere near ground level in what is known as the mixing depth. A stable layer exists above the mixing depth which restricts vertical diffusion.

- Wet deposition is zero (no rain occurs to accelerate deposition and reduce the area affected).

- Dry deposition of the cloud is modeled. During movement of the radioactive plume, a fraction of the plume is deposited on the ground due to gravitational forces and becomes available for exposure by ground surface radiation and ingestion.

Table F-6. Radiological Health Effects From Normal Operation

Possible Home Port Location	*Total Radiation Exposure to Affected Population from Normal Operation*[1]	*Annual Risk of Single Latent Fatal Cancer in Entire Affected Population from Normal Operation*[2]	*Population Estimate* **Within 50** *Miles of* **Home Port Location**[3]	*Average Annual Risk of Latent Fatal Cancer to a Member of the General Population from Normal Operation*[4]	*Individual Annual Risk of Latent Fatal cancer to the Maximally Exposed Off-Site Individual from Normal Operations*	*An Individual's Annual Risk of Dying from all Cancers*[6]
NASNI	2.4 (2.4×10^{0})	1 in 830 (1.2×10^{-3})	2,481,069	1 in 2 billion (4.8×10^{-10})	1 in 19 million (5.1×10^{-8})	1 in 360 (2.8×10^{-3})
PSNS	0.041 (4.1×10^{-1})	1 in 4,700 (2.1×10^{-4})	2,975,810	1 in 14 billion 6.9 x lo-“)	1 in 7 million (1.4×10^{-7})	1 in 360 (2.8×10^{-3})
PHNSY	0.041 (4.1×10^{-1})	1 in 4,700 (2.1×10^{-4})	817,385	1 in 4 billion (2.5×10^{-10})	1 in 45 million (2.2×10^{-8})	1 in 360 (2.8×10^{-3})
NAVSTA Everett	0.051 (5.1×10^{-1})	1 in 3,800 (2.6×10^{-4})	2,328,554	1 in 9 billion (1.1×10^{-10})	1 in 3 million (3.3×10^{-7})	1 in 360 (2.8×10^{-3})

Notes:
1. Total exposure to general population within a 50-mile radius of the facility due to normal operation (person-rem).
2. Annual risk of a single latent cancer fatality in the entire population within a 50-mile radius of the facility from radiation exposure due to normal operation, calculated by multiplying the total radiation exposure to affected population (rem) by 0.0005 latent fatal cancers estimated to be caused by each rem (risk/rem, See Table F-3 in Appendix F).
3. Estimated number of people within a 50-mile radius of the facility from census data from Table F-4.
4. Average annual risk of latent fatal cancer for an average individual within a 50-mile radius of the hcility from radiation exposure due to normal operation, calculated by dividing the total population cancer risk by the number of people within a 50 mile radius of the home port location. Risk of cancer is noted in parentheses.
5. The MOI is a theoretical individual living at the base boundary receiving maximum exposure, calculated by multiplying the total radiation exposure to the MOI (rem, see Table F-9 of Appendix F) by 0.0005 latent fatal cancers estimated to be caused by each rem (risk/rem, see Table F-3 in Appendix F).
6. Annual risk of an individual dying from all sources of cancer. Risk of cancer is noted in parentheses.

- The quantity of deposited radioactive material is proportional to the material size and speed. The following dry deposition velocities (m/s) were used: solids = 0.001; halogens = 0.01; noble gases = 0.0; cesium = 0.001; ruthenium = 0.001.

- If radioactive releases occur through a stack, then additional plume dispersion can be accounted for by calculating a jet plume rise. In this analysis, jet plume rise is ignored.

When released gases have a heat content, the plume can disperse more quickly. In this calculation, buoyant plume effects are ignored.

Table F-7. Analysis Results for Normal Operation

Location	Individual	Total EDE (rem)	Likelihood of Fatal Cancer
NASNI	Worker	1.3×10^{-3}	5x10-7 (1 in 2 million)
	NPA	1.9×10^{-4}	9.7×10^{-8} (1 in 10 million)
	MOI	1.0×10^{-4}	5.1×10^{-8} (1 in 19 million)
PSNS	Worker	1.1×10^{-3}	4.3×10^{-7} (1 in 2 million)
	NPA	1.8×10^{-3}	8.9×10^{-7} (1 in 1 million)
	MOI	2.8×10^{-4}	1.4×10^{-7} (1 in 7 million)
PHNSY	Worker	1.2×10^{-3}	4.6×10^{-7} (1 in 2 million)
	NPA	4.8×10^{-4}	2.4×10^{-7} (1 in 4 million)
	MOI	4.4×10^{-5}	2.2x10-e (1 in 45 million)
NAVSTA Everett	Worker	1.1×10^{-3}	4.3×10^{-7} (1 in 2.3 million)
	NPA	N/A	N/A
	MO1	6.6×10^{-4}	33×10^{-7} (1 in 3 million)

	Total Radiation Exposure to Affected Population from Normal Operation1	Annual Risk of Single Latent Fatal Cancer in Entire Affected Population from Normal Operation2	Average Annual Risk of Latent Fatal Cancer to a Member of the General Population from Normal Operation3
NASNI	2.4 (2.4×10^{0})	1 in 830 (12×10^{-3})	4.8×10^{-10} (1 in 2 billion)
PSNS	.41 (4.1×10^{-1})	1 in 4,700 (2.1×10^{-4})	6.9×10^{-11} (1 in 14 billion)
PHNSY	.41 (4.1×10^{-1})	1 in 4,700 (2.1×10^{-4})	2.5×10^{-10} (1 in 76 billion)
NAVSTA Everett	.51 (5.1×10^{-1})	1 in 3,800 (2.6×10^{-4})	1.1×10^{-10} (1 in 9 billion)

Notes 1. Total exposure to general population within a 50-mile radius of the facility due to normal operation (person-rem).
2. Annual risk of a single latent cancer fatality in the entire population within a 50-mile radius of the facility from radiation exposure due to normal operation.
3. Average annual risk of latent fatal cancer for an average individual within a 50-mile radius of the facility from radiation exposure due to normal operation.

Inhalation Data

- Breathing rate is 3.33×10^{-4} cubic meters per second (m^3/s) for worker and NPA; 2.66×10^{-4} m^3/s for people at site boundary and beyond.
- Particle size is 1.0 micron.
- The internal exposure period is 50 years for individual organs and tissues which have radionuclides committed to giving them dose.

- Exposure to the entire plume for the general public. The worker and NPA are exposed as discussed in section 2.1 of this appendix.

Inhalation exposure factors based on ICRP Publication 30 (ICRP 1979).

Ground Surface Exposure

- Exposed to contaminated soil for 1 year for the general public. See section **2.8** of this appendix for additional details.
- Building shielding factor is 0.7, which exposes the individual to contaminated soil for 16 hours a day.

Ingestion Data

- Ingestion numbers will be reduced by a factor of 10 to account for only 10 percent of the food consumed being grown locally (such as in a person's garden).
- The following changes from RSAC-5 defaults were used:
  - Annual Dietary Consumption Rates:
    - 177 Kg/yr Stored Vegetables (produce)
    - 18.3 Kg/yr Fresh Vegetables (leafy)
    - 94 Kg/yr Meat
    - 112 L/yr Milk

3.2 1 Fire Analysis

In this hypothetical accident scenario, a fire in a radiological support facility is postulated. The fire spreads to **radioactive material, which results in an airborne release of particulate.**

Conditions used in developing the source term are as follows:

- **The source term is based on 1.0 Curie of cobalt 60 and the associated proportioned amounts of other radioactive elements expected.**
- **The release to the environment occurs at a constant rate over 15 minutes.**
- **The following amounts of radionuclides were released to the environment:**

Radionuclides	*Release (Curies)*	*Radionuclides*	*Release (Curies)*
C-14	1.1×10^{-2}	Sr-90	8.4×10^{-4}
Mn-54	7.1×10^{-2}	Nb-94	2.1×10^{-4}
Fe-55	1.9	Nb-95	3.2×10^{-2}
Co-58	7.1×10^{-1}	Tc-99	1.1×10^{-5}
Co-60	1.0	I-129	4.3×10^{-8}
Ni-63	3.2×10^{-1}	Cs-137	4.2×10^{-4}

This listing includes nuclides that result in at least 99 percent of the possible exposure.

Table F-8 summarizes the public health risk to **the general population that might result** from the hypothetical support facility fire accident. "Risk" is defined as the number of fatal cancers times the probability of occurrence. The results are presented for the design basis accident with 95-**percent meteorology.** The total probability of occurrence of an event leading to a fire in the support facility is estimated to be in the range of 4 x 10^{-3} to 5 x 10^{-3} per year (Ganti and Krasner 1984). A value of 5 x 10^{-3} was used to develop the risk results in the table. The analyses showed that latent cancer fatalities are not expected in the general public, even for this severe hypothetical radiological fire. The average annual individual risk of a latent fatal cancer to the general public living within a 50-mile radius of the home port locations evaluated is very low, less than one chance in 580 million.

For the hypothetical support facility fire scenario, the radioactive plume might result in contamination of the ground to a downwind distance of 0.14 mile. This would yield a total area impacted by the accident of approximately 3 acres. The calculated downwind distance would be contained within the boundaries of all sites. Detailed results are contained in Table F-9. The probability of a fire occurring (0.005) is not included in the calculations for Worker, NPA, and MOI in Table F-9.

The annual risk of a single latent cancer fatality from a postulated radiological support facility fire at NASNI for the entire Mexican population within 50 miles of the facility is 1.9 x 10^{-3}. The analysis conservatively assumed that the entire population was located in an area of Mexico closest to the facility.

Table F-8. Summary of Radiological Support Facility Fire Results

Possible Home Port Location	Total Radiation Exposure to Affected Population from a Radiological Support Facility Fire, Assuming Fire occurs [1]	Annual Risk of Single Latent Fatal Cancer in Entire Affected Population from a Radiological Support Facility Fire, Including Probability of Fire Occurring[2]	Population Estimate Within SO Miles of Home Port Location [3]	Average Annual Risk of Latent Fatal Cancer to a Member of the General Population from a Radiological support Facility Fire, Including probability of a Fire Occurring[4]	Individual Annual Risk of Latent Fatal cancer for Maximally Exposed Off-Site Individual from a Radiological Support Facility Fire, Including Probability of Fire Occurring[5]	An Individual's Annual Risk of Dying from all Cancers [6]
NASNI	1,400 (1.4 x 10^{3})	1 in 285 (3.5 x 10^{-3})	2,481,069	1 in 700 million (1.4 x 10^{-9})	1 in 2 million (5.0 x 10^{-7})	1 in 360 (2.8 x 10^{-3})
PSNS	340 (3.4 x 10^{2})	1 in 1200 (8.5 x 10^{-4})	2,975,810	1 in 3.5 billion (2.9 x 10^{-10})	1 in 833,000 (1.2 x 10^{-6})	1 in 360 (2.8 x 10^{-3})
PHNSY	560 (5.6 x 10^{2})	1 in 700 (1.4 x 10^{-3})	817,385	1 in 580 million (1.7 x 10^{-9})	1 in 2 million (4.4 x 10^{-7})	1 in 360 (2.8 x 10^{-3})
NAVSTA Everett [7]	350 (5.5 x 10^{2})	1 in 700 (1.4 x 10^{-3})	2,328,584	1 in 1.7 billion (6.0 x 10^{-10})	1 in 470,000 (2.2 x 10^{-6})	1 in 360 (2.0 x 10^{-3})

Note: 1. Total exposure to general population within a SO-mile radius of the facility due to a fire (person-rem).

2. Annual risk of a single latent cancer fatality in the entire population within a 50-mile radius of the facility from radiation exposure due to a fire. Calculated by multiplying the total radiation exposure to affected population (rem) by 0.0005 latent fatal cancers estimated to be caused by each rem (risk/rem; see Table F-3 in Appendix F) by a 1 in 200 (0.005) probability of a fire.
3. Estimated number of people within a 50-mile radius of the facility from census data from Table F-4.
4. Average annual risk of latent fatal cancer for an average individual within a 50-mile radius of the facility from radiation exposure due to a fire, calculated by dividing the total population cancer risk by the number of people within a 50 mile radius of the home port location. Risk of cancer is noted in parentheses.
5. The MOI is a theoretical individual living at the base boundary receiving maximum exposure. Risk is calculated by multiplying the total radiation exposure to the MOI (rem; see Table F-9 of Appendix F) by 0.0005 latent fatal cancers estimated to be caused by each rem (risk/rem; see Table F-3 in Appendix F) by a 1 in 200 (0.005) probability of a fire.
6. Annual risk of an individual dying from all sources of cancer. Risk of cancer is noted in parentheses.
7. Analysis included even though no radiological support facility is planned for NAVSTA Everett.

Table F-9. Analysis Results for Radiological Support Facility Fire, Assuming Accident Occurs

Location	*Individual*	*Total EDE (rem)*	*Likelihood of Fatal Cancer*
NASNI	Worker	6.0×10^{-1}	2.4×10^{-4} (1 in 4,167)
	NPA	9.0×10^{-1}	4.5×10^{-4} (1 in 2,222)
	MOI	2.0×10^{-1}	1.0×10^{-4} (1 in 10,000)
PSNS	Worker	6.0×10^{-1}	2.4×10^{-4} (1 in 4,167)
	NPA	6.2×10^{-1}	3.1×10^{-4} (1 in 3,226)
	MOI	4.7×10^{-1}	2.4×10^{-4} (1 in 4,167)
PHNSY	Worker	6.0×10^{-1}	2.4×10^{-4} (1 in 4,167)
	NPA	2.0×10^{-1}	1.0×10^{-4} (1 in 10,000)
	MOI	1.8×10^{-1}	8.8×10^{-5} (1 in 11,364)
NAVSTA Everett	Worker	6.0×10^{-1}	2.4×10^{-4} (1 in 4,167)
	NPA	3.2×10^{-1}	1.6×10^{-4} (1 in 6,250)
	MOI	8.6×10^{-1}	4.3×10^{-4} (1 in 2,326)
	Total Radiation Exposure to Affected Population from a Radiological Support Facility Fire, Assuming Fire Occurs [1]	*Number of Latent Fatal Cancers in General Population*	*Annual Risk of Single latent Fatal Cancer in Entire A&ted Population from a Radiological Support Facility Fire, Including Probability of Fire Occurring* [2]
NASNI	1.4×10^{3}	7.0×10^{-1}	3.5×10^{-3} (1 in 286)
PSNS	3.4×10^{2}	1.7×10^{-1}	8.5×10^{-4} (1 in 1,176)
PHNSY	5.6×10^{2}	2.8×10^{-1}	1.4×10^{-3} (1 in 174)
NAVSTA Everett [3]	5.5×10^{2}	2.7×10^{-1}	1.4×10^{-3} (1 in 174)

Vote :
1. Total exposure to general population within a SO-mile radius of the facility due to a fire (person-rem).
2. Annual risk of a single latent cancer fatality in the entire population within a 50-mile radius of the facility from radiation exposure due to a fire.
3. **No radiological support facility at NAVSTA Everett.**

3.2.2 Spill Analysis

In this hypothetical accident scenario, the entire contents of a storage tank are spilled into the water surrounding the radiological support facility due to severe rupture. The scenario is conservative since it would require a spill of over 26 million gallons of radioactive liquid at levels normally contained in collection facilities that have tanks no larger than 10,000 gallons. Furthermore, the total capacity to store radioactive liquid at support facilities at all locations would be less than 100,000 gallons. This amount was used to conservatively bound the amount of activity released to 1.0 Curie of cobalt 60 and the associated proportioned amounts of other radioactive elements expected.

Conditions used in developing the source term are as follows:

- The source term is based 1.0 Curie of cobalt 60 and the associated proportioned amounts of other radioactive elements expected.

- The following amounts of radionuclides were released to the environment:

This listing includes nuclides that result in at least 99 percent of the possible exposure.

Table F-10 summarizes the public health risk to the general population that might result from the hypothetical release of radioactive liquid accident. "Risk" is defined as the number of fatal cancers times the probability of occurrence. The results are presented for the design basis accident with 95-percent meteorology. The total probability of occurrence of an event leading to a release of radioactive liquid is estimated to be in the range of 10^{-4} to 10^{-8} per year. A value of 1×10^{-4} was used to develop the risk results in the table. The analyses showed that no latent cancer fatalities would be expected in the general public, even for this severe hypothetical radioactive liquid release. The average annual individual risk of a latent fatal cancer to the general public living within a 50-mile radius of the home port locations evaluated is very low, less than one chance in 38 billion. Detailed results are contained in Table F-11. The probability of a spill occurring (0.0001) is not included in the calculations of Worker, NPA, and MOI in Table F-11.

Radionuclides	Release (Curies)	Radionuclides	Release (Curies)
C-14	1.1×10^{-2}	Sr-90	8.4×10^{-4}
Mn-54	7.1×10^{-2}	Nb-94	2.1×10^{-4}
Fe-55	1.9	Nb-95	3.2×10^{-2}
Co-58	7.1×10^{-1}	Tc-99	1.1×10^{-5}
Co-60	1.0	I-129	4.3×10^{-8}
Ni-63	3.2×10^{-1}	Cs-137	4.2×10^{-4}

The annual risk of a single latent cancer fatality from a postulated radiological support facility radioactive liquid release at NASNI for the entire Mexican population within 50 miles of the facility is 2×10^{-5}. The analysis conservatively assumed that the entire population was located in an area of Mexico closest to the facility.

1

Table F-10. Summary of Release of Radioactive Liquid Results

Possible Home Port Location	*Total Radiation Exposure to Affected Population from a Radiological support Facility Spill, Assuming Spill occurs* [1]	*Annual Risk of Single Latent Fatal Cancer in Entire Affected Population from a Radiological Support Facility Spill, Including Probability of Spill Occurring* [2]	*Population Estimate Within 50 Miles of Home Port Location* [3]	*Average Annual Risk of Latent Fatal Cancer to a Member of the General Population from a Radiological Support Facility Spill, Including Probability of Spill Occurring* [4]	*Individual Annual Risk of Latent Fatal Cancer for Maximally Exposed Off-Site Individual from a Radiological Support Facility Spill, Including Probability of Spill Occurring* [5]	*An Individual's Annual Risk of Dying from all Cancers* [6]
NASNI	**1,300**	**1 in 15,000 (6.5 x 10^{-5})**	**2,481,069**	**1 in 38.5 billion (2.6 x 10^{-11})**	**1 in 360 million (2.8 x 10^{-9})**	**1 in 360 (2.8 x 10^{-3})**
PSNS	**260**	**1 in 77,000 (1.3 x 10^{-5})**	**2,975,810**	**1 in 227 billion (4.4 x 10^{-12})**	**1 in 2 billion (4.8 x 10^{-10})**	**1 in 360 (2.8 x 10^{-3})**
PHNSY	**73**	**1 in 278,000 (3.6 x 10^{-6})**	**817,385**	**1 in 227 billion (4.4 x 10^{-12})**	**1 in 2 billion (4.8 x 10^{-10})**	**1 in 360 (2.8 x 10^{-3})**
NAVSTA Everett [7]	**210**	**1 in 100,000 (1.0 x 10^{-5})**	**2,328,554**	**1 in 232 billion (4.3 x 10^{-12})**	**1 in 2 billion (4.8 x 10^{-10})**	**1 in 360 (2.8 x 10^{-3})**

Note:

1. **Total exposure to general population within a 50-mile radius of the facility due to a spill (person-rem).**
2. **Annual risk of a single latent cancer fatality in the entire population within a 50-mile radius of the facility from radiation exposure due to a spill. Calculated by multiplying the total radiation exposure to affected population (rem) by 0.0005 latent fatal cancers estimated to be caused by each rem (risk/rem; see Table F-5 in Appendix F) by a 1 in 10,000 (0.0001) probability of a spill.**
3. **Estimated number of people within a SO-mile radius of the facility from census data from Table F-4.**
4. **Average annual risk of latent fatal cancer for an average individual within a 50-mile radius of the facility from radiation exposure due to a spill, calculated by dividing the total population cancer risk by the number of people within a 50 mile radius of the home port location. Risk of cancer is noted in parentheses.**
5. **The MOI is a theoretical individual living at the base boundary receiving maximum exposure. Risk is calculated by multiplying the total radiation exposure to the MOI (rem; see Table F-13 of Appendix F) by 0.0005 latent fatal cancers estimated to be caused by each rem (risk/rem; see Table F-5 in Appendix F) by a 1 in 10,000 (0.0001) probability of a spill.**
6. **Annual chance of an individual dying from all sources of cancer. Risk of cancer is noted in parentheses.**
7. **Analysis included even though no radiological support facility is planned for NAVSTA Everett.**

2

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Table F-11. Analysis Results for Release of Radioactive Liquid, Assuming Accident Occurs			
Location	*Individual*	*Total EDE (rem)*	*Likelihood of Fatal Cancer*
NASNI	Worker	N/A	N/A
	NPA	1.1×10^{-4}	5.5×10^{-8} (1 in 18 million)
	MOI	5.6×10^{-2}	2.8×10^{-5} (1 in 35,000)
PSNS	Worker	N/A	N/A
	NPA	1.9×10^{-6}	9.5×10^{-10} (1 in 1 billion)
	MOI	9.6×10^{-3}	4.8×10^{-6} (1 in 208,000)
PHNSY	Worker	N/A	N/A
	NPA	1.9x 10”	9.5×10^{-10} (1 in 1 billion)
	MOI	9.6×10^{-3}	4.8×10^{-6} (1 in 208,000)
NAVSTA Everett [3]	Worker	N/A	N/A
	NPA	1.9×10^{-6}	95×10^{-10} (1 in 1 billion)
	MOI	9.6×10^{-3}	4.8×10^{-6} (1 in 208,000)
	Total Radiation Exposure to Affected Population from a Radiological Support Facility Spill, Assuming Spill Occurs[1]	*Number of Latent Fatal Cancers in General Population*	*Annual Risk of Single Latent Fatal Cancer in Entire Affected Population from a Radiological Support Facility Spill, Including Probability of Spill Occurring*[2]
NASNI	1.3×10^{3}	6.5x10-l	6.5x10-5 (1 in 15,000)
PSNS	2.6×10^{2}	1.3×10^{-1}	1.3×10^{-5} (1 in 76,000)
PHNSY	7.3×10^{1}	3.6×10^{-2}	3.6×10^{-6} (1 in 277,000)
NAVSTA Everett [3]	2.1×10^{2}	1.0×10^{-1}	1.0×10^{-5} (1 in 100,000)

Note:
1. **Total exposure to general population within a 50-mile radius of the facility due to a fire (person-rem).**
2. **Annual risk of a single latent cancer fatality in the entire population within a 50-mile radius of the facility from radiation exposure due to a fire.**
3. **No radiological support facility at NAVSTA Everett.**

3.3 CUMULATIVE IMPACTS

Since the CVNs addressed in this EIS would add to the total number of nuclear-powered ships present in the San Diego, Pacific Northwest, and Pearl Harbor areas, cumulative radiological impacts to the specific locations were analyzed. For instance, in the Pacific Northwest, nuclear-powered ships would be located at PSNS, NAVSTA Everett, and Submarine Base Bangor. In San Diego, nuclear-powered ships would be located at NASNI and Submarine Base San Diego, and in Pearl Harbor, nuclear-powered ships would be located at PHNSY and Submarine Base Pearl. These analyses show that the cumulative radiological impacts associated with homeporting NIMITZ-class aircraft carriers at any of the locations being considered are very small.

The analyses conservatively assume that all of the nuclear-powered ships in the area were at the potential home port location. For instance, the analysis for NASNI assumes three CVNs and six submarines from Submarine Base San Diego are all present at NASNI. The analyses results show that the maximally exposed member of the public would receive less than 1 millirem of radiation exposure each year due to the additional homeporting operations. This exposure is so small that it is indistinguishable from naturally occurring background radiation. The additional annual radiation exposure to the entire population within 50 miles of each homeporting location ranges from 0.4 person-rem to 2.4 person-rem. The cumulative impact of this additional radiation exposure is shown in the following table, which compares the average annual individual risk of a member of the public developing a latent cancer fatality due to all Naval nuclear propulsion

Location	*Average Annual Individual Risk of latent Cancer Fatality from Normal Operations to a Member of the General Population (Existing Condition without Additional CVNs)*	*Average Annual Individual Risk of Latent Cancer Fatality from Normal Operations to a Member of the General Population (Condition with Additional CVNs)*
NASNI	**1 chance in 1.7 billion**	**1 chance in 1.0 billion**
PSNS	**1 chance in 3.4 billion**	**1 chance in 2.9 billion**
Pearl Harbor Naval Complex	**1 chance in 1.2 billion**	**1 chance in 1.0 billion**
NAVSTA Everett	1 chance in 2.2 **billion**	1 chance in 1.8 **billion**

program operations in the surrounding area, both with and without additional CVNs.

The risks in the first column were determined using the same analytical methods discussed in this appendix for radioactivity projected to be released into the air during calendar year 1998 from all Naval nuclear operations within 50 miles of each of the four locations evaluated. The risks in the second column represent the cumulative risks, including the impacts associated with homeporting additional CVNs at those locations, and were determined by adding the risks from Table F-7 in this appendix to those in the first column. For example, within 50 miles of PSNS, NNPP operations are also conducted at Submarine Base Bangor and NAVSTA Everett. The average individual risk of developing a latent cancer fatality due to normal operations at all three locations is 2.9×10^{-10} or about one chance in 3.4 billion. From Table F-7, the risk associated with homeporting an additional NIMITZ-class aircraft carrier is 6.9×10^{-11} or about one chance in 14 billion. To determine the cumulative impact, the risks are added together (for a total of 3.4×10^{-10}) or about one chance in 2.9 billion. Similar calculations were performed for the three other locations, resulting in the risks presented in the table above.

APPENDIX G

COMPARISON OF CVN HOME PORT SITE ALTERNATIVES

APPENDIX G

COMPARISON OF CVN HOMEPORTING ALTERNATIVES

1.0 CVN HOME PORT LOCATION REQUIREMENTS AND OBJECTIVES

The Home Port Analysis for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet (DON 1997a) encompassed a planning process to determine feasible and practicable locations for the CVNs. Fundamental to the development of a listing of alternative locations for homeporting a CVN was the examination of those factors associated with day-to-day CVN operation. In broad terms, those factors can be described in four categories: operations and training; facilities (infrastructure); maintenance; and quality of life of the crew. Embedded within those four categories are individual *factors,* some of more significance than others; for instance, access to the sea and ability to perform propulsion plant maintenance are considered two of the more important. Family separation (a quality of life issue) is also afforded considerable weight.

The decades-old presence of the Navy on the west coast of the United States and in Hawaii has resulted in a natural winnowing process as it relates to home port location suitability. When combined with the decision to not consider BRAC-closed sites such as Alameda and Long Beach, California, the list of eligible locations for a CVN was small at the start. Consequently, the examination of the factors referred to in the paragraph above became important not so much in locating candidate locations for one CVN but in identifying which of the alternative locations could accommodate multiple CVNs. This appendix provides detailed tables displaying the rating of various alternative locations versus the number of CVNs that might be homeported there and serves to provide the background for the development of the homeporting alternatives shown in Table 2-l of Chapter 2.

1.1 OPERATIONS AND TRAINING REQUIREMENTS

- *Access to the Sea. The* ship must have unrestricted or nearly unrestricted access to the sea, **e.g., the combination of tides, currents, wave actions, and water depth must not** unduly prohibit the coming and going of the CVN from its home port.
- *Proximity of the Carrier to its Air Wing.* When not deployed, the carrier's air wing is shorebased at **various locations** along the West Coast of the United States. The distance and time involved in mating the carrier and air wing must present neither a warfighting readiness restriction, an unacceptable recurring economic burden, nor result in a significant QOL impact for the crew.
- *Proximity of the Carrier to Other Assigned Battle Group Ships. The majority* of the Pacific Fleet's battle group ships are located on the West Coast of the United States. Intra-battle group training is fundamental to combat readiness and is conducted at least three and usually four times prior to a battle group's extended deployments.

- ***Proximity of Air-to-Ground Weapons Delivery Ranges. The*** assigned air wing, both while shorebased and embarked, make nearly daily use of these ranges. Battle group training requires the use of the ranges for coordinated strike warfare and close air support practice.

- ***Proximity of At-Sea Tactical Ranges.*** The assigned air wing force-defense aircraft as well as the anti-submarine warfare aircraft require at-sea ranges for training. The coordinated battle group anti-air warfare training requirements necessitate instrumented at-sea ranges.

- ***Proximity of Opposing Force/Electronic Warfare.*** Battle group tactics require the presence of non-organic opposing forces supplied by West Coast-based aircraft. Battle group ships require electronic countermeasure and detection facilities close to training ranges for crew training and system calibration. Aircrews require pre-deployment electronic warfare countermeasure training obtained at West Coast ranges.

- ***Proximity of "Schoolhouse" Training.*** Classroom training is required by the entire spectrum of battle group personnel: ship, aircrew, air wing maintenance, and staff. The cost of transporting large quantities of personnel to and from the schoolhouse must not be exorbitant.

- ***Ability to Perform Fleet Carrier Qualifications.*** Fleet carrier qualifications are a primary task of all carriers, the frequency of which is dictated by the necessity to keep air wing pilots proficient as well as the requirement to qualify pilots undergoing readiness squadron training. The requirement for the carrier to operate in the vicinity of suitable and multiple airfields must also be considered.

- ***Ability to Perform Training Command Carrier Qualifications.*** Training command carrier qualifications are a requirement similar to the Fleet carrier qualifications except that the carrier used must operate close to the West Coast because the training command aircraft cannot make long over-water flights, nor are the training command student pilots qualified to do so.

1.2 FACILITY OBJECTIVES

- ***Turning Basin.*** CVNs are one of the deepest-draft ships in the Navy. Current Naval Sea Systems Command policy (Commander, Naval Sea Systems Command letter Serial 03D3/242 dated 3 Jan 95 [DON 1995c] and NAVFAC Criteria [DON 1997b, 1997d]) for CVNs prescribes a minimum water depth of 50 feet for home port/port of call turning basins, and at least 47 feet of water depth for shipyard maintenance berthing areas.

- ***Berth.*** Depth of water at home port berths must provide at least 50 feet of water depth and at maintenance berths at least 47 feet of depth is required (it is presumed that CVNs undergoing maintenance at shipyards will be lightly loaded, thus requiring less water depth — Commander, Naval Sea Systems Command letter Serial 03D3/242 dated 3 Jan 95). Two-sided carrier piers are to be a minimum of 125 feet wide. Wharves or piers with one side are to be a minimum of 80 feet wide. Pier and wharf length should be a minimum of 1,300 feet. Pier strength should support a live load of 800 pounds per square foot. Mobile crane loads should equal two 140-ton cranes. There should be at least 13 100-ton-minimum normal-weather bollards (tie down anchors) and eight 200-ton-minimum storm bollards (DON 1997b).

- *Berth Utilities.* Transformers should be off-deck (on-deck transformers require 25 feet additional pier width). Shore power must be delivered through two independent transformers rated at least 10 megavolt amperes (MVA) each to provide a minimum total of 2,880 amps at 4,160 volts. Certified pure steam must satisfy peak ship demand of 50,000 pounds per hour. Potable water must meet a peak demand of 1,000 gallons per minute (gpm) at 40 pounds per square inch and 155,000 gallons per day (gpd). Pure water is required at the peak rate of 10,000 gpd. Compressed air must meet a demand of 2,400 standard cubic feet per minute. The sanitary sewer must accommodate 400 gpm with capacity for 310,000 gpd. Oily waste collection must be at the rate of 200 gpm with capacity for 288,000 gpd peak.

- *Transient Warehouse.* The transient warehouse space requirement is 28,000 gross square feet.

- *Parking.* Naval Facilities Command parking requirement stipulates one parking spot for every two non-deployed crew members. For a CVN this computes to approximately 1,600 parking spaces.

1.3 MAINTENANCE OBJECTIVES

Aircraft carrier maintenance is arranged into three categories: organizational, intermediate, and depot levels. Organizational level (routine) maintenance can be accomplished by the ship's crew using equipment and systems on board the vessel. Intermediate level maintenance is more complex, requiring an Intermediate Maintenance Activity (IMA) with more complete repair capabilities than that found aboard the ship. Depot-level maintenance is performed when major repairs or a complete rebuild of all or portions of a CVN propulsion plant system component is needed. This maintenance is accomplished at a public or private shipyard and by civilian Master Ship Repair contractors, and requires extensive, local industrial capabilities.

The extent to which these depot-level maintenance components described below exist or are capable of being built are a major objective for siting a CVN home port. Having these facilities at the home port also helps keep the crew members near their families for the maximum time possible (see QOL discussion below).

The Navy has adopted a new maintenance plan for CVNs. As a result of this plan, CVNs will perform maintenance more frequently but for a shorter duration. Coupled with Navy Personnel Tempo of Operations (PERSTEMPO) guidance to minimize time sailors are away from home port, this work needs to be accomplished in the ship's home port area as much as practicable. Naval Station Everett, which is currently a home port for one CVN, does not have the necessary depot-level maintenance infrastructure. This EIS therefore evaluates several alternatives to provide that maintenance without requiring the crew of the CVN and their families to be separated for long periods. Three solutions to this problem are analyzed. These include building the necessary maintenance facilities at Everett, finding a mechanism to transport the crew to the Puget Sound Naval Shipyard in reasonable period of time, or changing the home port of the CVN.

- *Depot Maintenance Facilities (DMF).* A DMF is required to perform depot-level maintenance of CVN propulsion plant systems and components in a home port, not adjacent to a nuclear-capable shipyard. The DMF includes a Controlled Industrial Facility (CIF), a Ship Maintenance Facility (SMF), and a Maintenance Support Facility (MSF). The CIF is used for the inspection, modification and repair of radiologically controlled equipment and components associated with naval nuclear propulsion plants. The SMF houses the machine tools, industrial processes and work functions necessary to perform non-radiological depot-level maintenance on CVN propulsion plants. The MSF houses the primary administrative and technical staff offices supporting CVN propulsion plant maintenance, as well as the central area for receiving, inspecting, shipping and storing materials. The DMF must support a daily work force of between 450 and 1,300 staff including the on-board workers, facility workers, and the project management team, depending upon how much non-propulsion plant maintenance is performed by local area private contractors. Each home port location varies to how much contract work is performed.

- *Access to Infermediate-Level Maintenance.* Intermediate-level maintenance is one increment lower than depot-level maintenance. It is more complex than maintenance routinely performed by the ship's crew and can be satisfied by an intermediate-level activity such as a Navy Shore Intermediate Maintenance Activity (SIMA) or by qualified civilian contractor personnel. Such maintenance capability must be readily available to the ship.

- *Crane Support.* Piers/wharves need to accommodate up to a 140-ton crane. Portal cranes and floating cranes may be used in addition to or in lieu of mobile cranes.

- *Access to Dry Dock.* Maintenance at a dry dock is required once every 6 years; the CVN must undergo a docking that lasts approximately 10 months. This docking permits, among other *things,* the maintenance of the hull beneath the waterline, the removal of propellers, and the removal/maintenance of propeller shafts.

- *Laydown Area.* A minimum of 5 acres of laydown area is typically needed.

- *Non-Propulsion Plant Maintenance.* Non-propulsion plant maintenance is performed every time the ship is in port. Consequently, though not a requirement in the strictest sense, the cost of doing this work on a site-comparative basis is a significant factor in the analysis of the potential homeporting locations.

CVN Incremental Maintenance Plan

A maintenance plan for NIMITZ-class aircraft carriers, the Incremental Maintenance Plan, has been implemented. Over an aircraft carrier's 2-year operating cycle, 6 months are spent on an overseas deployment and 6 months are spent in a work-intensive depot level maintenance period known as a PIA, during which major repairs are accomplished. Twelve months are spent in CVN operational training that includes several routine maintenance periods. At every third cycle or approximately 6 years, the nearly 6-month maintenance availability is replaced by a 10- to 11-month dry-docking phase (major maintenance period) to complete hull work and other labor-intensive maintenance.

In the Pacific Fleet, only PSNS Bremerton has the full capabilities to perform all aspects of CVN depot-level repair work (dry-docking or pierside repairs). NASNI is currently constructing facilities to support pier-side repairs of the CVN nuclear propulsion plant. PHNSY has dry-docking and depot-level capabilities. However, PHNSY lacks some specialized facilities and pieces of equipment to perform CVN PIA and Drydocking Planned Incremental Availability (DPIA) maintenance. NAVSTA Everett currently has no facilities capable of CVN depot-level propulsion plant repair work.

To support the 2-year operational cycle and include time for CVN personnel to be with their families, the nearly 6-month PIA is planned to be accomplished in the ships' permanent home port area. If the PIA occurs in a different home port area, and the availability is less than 6 months in duration (which is the case for a PIA), funding for moving crew families would not be provided under Navy policy. Further, the PIA availability would be considered to apply against PERSTEMPO sailor QOL objectives (see section 1.4) for family separation because the ship would be out of its home port for more than 56 days.

An alternative to relocating CVN crew and families during each PIA is to temporarily transfer a work force from naval shipyards or private contractors to the respective home port location that has available maintenance capabilities for the nearly 6-month PIA duration.

In those instances where the above alternative is not possible due to lack of facilities at the home port, the amount of time that the crew is absent from its home port must be minimized through all means available.

The extent to which these DMF components exist or are capable of being built are a major criterion for siting a CVN home port. Having these facilities at the home port also helps keep the crew members near their families for the maximum time possible (see Quality of Life discussion below).

1.4 QUALITY OF LIFE

Adequate QOL for the ship's crew members and their families is a primary goal of the Navy. QOL is a common term in the Navy referring to the sum of all the factors, quantitative and otherwise, that contribute to Navy members' satisfaction with their career situation. QOL applies to members' families as well as to the individual service members. One of the more important QOL considerations is the following:

- Family separation. This consideration is the single most often mentioned factor in a Navy-member's satisfaction rating with his/her job. One of the major scheduling criteria for ship operations is related to the amount of time that Navy personnel spend away from their home port. The duration is limited to minimize family separation, which is a primary quality of life issue for Navy personnel and that has a significant effect on retention. The Navy's objective is to arrange a ship's schedule such that 2 days are spent in the home port for every day that is spent on deployment. Therefore, a ship that has deployed for 6 months must spend a minimum of 12 months back in its home port before it can deploy again. Any continuous period of about 2 months or more out of home port is considered a deployment. Home port changes have normally been executed during deployments to a shipyard for accomplishment of the complex overhaul. An official home port change allows a Navy family to relocate to the ship's "interim" shipyard home port at government expense, thus minimizing family separation. For example, a CVN homeported at NASNI would execute a home port change for accomplishment of a 10- to ll-month drydocking availability at PSNS. Another home port change back to NASNI would be executed following the availability.

Other important considerations include:

- Career employment and advancement opportunity
- Living and working environment
- Cost of living
- schools
- Housing
- Military grocery and retail shopping
- Recreational opportunities
- Medical and dental care facilities
- Commuting and parking

2.0 COMPARISON OF HOME PORT LOCATIONS

Graphic representations of the development process described in Chapter 1.0 are provided in Tables G-l through G-16, in which the various sites and quantities of homeported CVNs are juxtaposed with the homeporting objectives. The potential number of CVNs for each home port location are indicated in the "number of CVNs" column. The summary of key homeporting objectives are then summarized for each potential number of CVNs at each alternative location. Colors are assigned to each objective and number of CVNs. While the definition of these colors varies somewhat, depending on the objective under consideration, the general meaning is as follows:

Green: Satisfies homeporting objectives.

Yellow: Satisfies homeporting objectives with moderate effort.

Red: **Satisfies** homeporting objectives only with extensive effort/cannot satisfy.

2.1 NASNI, CORONADO, CALIFORNIA

2.1.1 Operations and Training

NASNI provides ready access to the Pacific Ocean and the Southern California (SOCAL) training areas. These training ranges provide at-sea tactical training, opposing forces and electronic warfare exercises, fleet carrier qualifications, and training command qualifications. Embarking the air wing is easily facilitated from the air field adjacent to the carrier piers. With the many military air stations in the immediate area, divert fields are readily available for embarked air wings and carrier qualification operations. Comman der, Third Fleet (who oversees all carrier readiness and training) and the battle group commanders are all stationed in San Diego as are many of the ships that constitute the battle group.

Each of the factors listed in section 1.1, Operations and Training Requirements, is evaluated in **Table G-l and assigned a rating of green for all alternatives.**

A rating of green is assigned to all CVN combinations **(a total** of one, two or three CVNs) because NASNI is adjacent to the SOCAL **training** areas, and no transit time is required for CVN operations **and** training.

2.1.2 Facilities

Currently, NASNI has three aircraft carrier berths, with one that can support a transient CVN. The remaining two berths are suitable only for CVs or smaller ships. Construction is currently underway in support of a BRAC 95 decision to provide a fully capable CVN home port berth and adequate water depths at the berth, turning basin, inner channel, and outer channel.

Each of the factors listed in section 1.2, Facilities Objectives, is evaluated and presented in Table **G-2.**

A rating of red is assigned to Alternative Four factors Berth and *Berth Utilities* because a complete new berth must be constructed. A rating of red is assigned to Alternative Six factor Berth, reflecting the unsatisfactory operational restriction of having to home port the second CVN at the existing transient berth.

A rating of yellow is assigned to Alternatives One, Two, and Three factors Berth and Berth *Utilities* to clearly show that once the second CVN is accommodated at a new berth, the third CVN requires only minor upgrades to the utilities, lighting, and security fencing already present at the transient berth.

2.1.3 Maintenance

When construction is completed, the NASNI DMF will provide all necessary maintenance support for the accomplishment of CVN PIAs and upkeep periods. These facilities are capable of accommodating the staggered maintenance schedules of three homeported CVNs.

Each of the factors listed in section 1.3, Maintenance Objectives, is evaluated and presented in Table G-3.

Red ratings are identified for all alternatives within the factor of *Dry Dock Availability,* because the only suitable dry dock for CVN maintenance on the West Coast is located at PSNS. A rating of yellow is associated with *Cost of Propulsion Plant Maintenance* because the workers must be transferred from a nuclear-capable shipyard with the concomitant extra expense of per diem, lodging, transportation, etc.

2.1.4 QOL

On balance, the QOL in the San Diego region is considered good with the exceptions of the cost of housing and commuting. The large array of Department of the Navy bases in the area provide excellent personnel support functions.

Each of the factors listed in section 1.4, QOL Objectives, is evaluated and presented in Table G-4.

A rating of yellow is assigned to the *Overall Rating* for all alternatives primarily due to the Family Separation caused by the requirement for the CVN to move to PSNS once every 6 years to undergo approximately 10 months of dry dock maintenance (see Maintenance Objectives above). The Navy will pay to relocate the families of the crew to Bremerton, Washington during the maintenance period. Consequently, a rating of yellow is assigned to what otherwise would be an onerous family separation. Constrained school capacities, relatively high housing costs, commuting pressures and relatively high cost of living contribute to a yellow QOL characterization for all proposed action alternatives.

Table G-l. Operations and Training Factors for NASNI, Coronado

Factors	Alt 1 (3 CVN)	Alt 2 (3 CVN)	Alt 3 (3 CVN)	Alt4 (2 CVN)	Aft5 (1 CVN)	Alt 6 (2 CVN)
Access to Sea	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Proximity to Air Wing	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Proximitv to Battle Groun	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Air-to-Ground Weapons Deliverv	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
At-Sea Tactical Ranges	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Opposing Forces /Electronic Warfare	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Fleet Carrier Qualifications	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Training Command Qualifications	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Overall Rating	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

2

Table G-2. Facilities Factors for NASNI, Coronado

Factors	Alt 1 (3 CVN)	Alt 2 (3 CVN)	Alt 3 (3 CVN)	Alt 4 (2 CVN)	Alt 5 (1 CVN)	Alt 6 (2 CVN)
Turning Basin	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Berth	Y	Y	Y	[redacted]	[redacted]	[redacted]
Berth Utilities	Y	Y	Y	[redacted]	[redacted]	[redacted]
Warehouse	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Parking	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Overall Rating	Y	Y	Y	[redacted]	[redacted]	[redacted]

3

Table G-3. Maintenance/Support Factors for NASNI, Coronado

Factors	Alt 1 (3 CVN)	Alt 2 (3 CVN)	Alt 3 (3 CVN)	Alt 4 (2 CVN)	Alt 5 (1 CVN)	Alt 6 (2 CVN)
Cost of Top Side Maintenance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Cost of Propulsion Plant Maintenance	Y	Y	Y	Y	Y	Y
Depot Maintenance Facility	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dry Dock	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Crane Support	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Laydown Area	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Overall Rating	Y	Y	Y	Y	Y	Y

4

Table G-4. QOL Factors for NASNI, Coronado

Factors	Alt 1 (3 CVN)	Alt 2 (3 CVN)	Alt 3 (3 CVN)	Alt 4 (2 CVN)	Alt 5 (1 CVN)	Alt 6 (2 CVN)
Family separation	Y	Y	Y	Y	Y	Y
Career/advancement opportunity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Living and working; environment	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Cost of living	Y	Y	Y	Y	Y	Y
Schools	Y	Y	Y	Y	Y	Y
Housing	Y	Y	Y	Y	Y	Y
Military shopping	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Recreational opportunities	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Medical and dental care facilities	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Commuting and parking	Y	Y	Y	Y	Y	Y
Overall QOL Rating	Y	Y	Y	Y	Y	Y

2.2 PSNS, BREMERTON, WASHINGTON

2.2.1 Operations and Training

PSNS provides nearly unrestricted access to deep water and the sea through Rich Passage, Puget Sound, and the Strait of Juan de Fuca. In a crisis-response action, the air wing support infrastructure can be embarked at Bremerton by using Kitsap County Airport as an air head. With the exception of limited electronic warfare training support at Whidbey Island, air wing and battle group training must be accomplished in SOCAL.

Each of the factors listed in section 1.1, Operation and Training Requirements, is evaluated in Table G-5. With the exception of the factor *Access to the Sea,* a rating of yellow is assigned to all alternatives due to the 6-day round trip transit time required to use the SOCAL training areas a minimum of four times each 2-year deployment cycle. The factor *Access to the Sea* is rated yellow due to the limitations imposed by Rich Passage, which lies between PSNS and the open waters of Puget Sound.

Ships transiting to or from PSNS to the sea must pass through Rich Passage, a narrow waterway with swift currents during tidal changes. Due to the swift current and limited maneuverability in the narrow passage, CVNs transiting Rich Passage do so only during conditions of slack or nearly slack water (when currents are 1 knot or less). CVN transit is also limited by the depth of the channel. Several points in Rich Passage have a maximum depth of 40 feet MLLW. CVNs transiting the passage do so during high tide **to ensure a minimum** depth of 50 feet. While physical conditions **in Rich Passage** restrict CVN transit, a CVN homeported at PSNS would still be able to get underway and respond to emergency situations within 96 hours.

2.22 Facilities

PSNS currently has three CVN capable berths: Pier B, Pier D (west side), and Pier 3 (east side). Pier B is the primary CVN home port pier and a maintenance pier for drydockings, Pier D is a backup CVN home port pier, and Pier 3 is the primary CVN maintenance pier. Pier D currently functions as a home port pier for AOEs. Pier 3 is located within the PSNS CIA.

The potential area for CVN homeporting encompasses the area between Pier B and Pier D in the Shipyard. Piers west of Pier D are utilized for inactive ship mooring, and are considered to be essential for continuing the PSNS mission. Piers east of Pier B are within the CIA, and are undesirable for homeporting purposes, **because** of conflicts with the maintenance mission of the Shipyard and sailor quality of life. Pier C is inadequate in length and design to adequately serve as a CVN pier. Because all available berths are currently being used, addition of any CVNs at PSNS would require relocation of AOEs.

Each of the factors listed in section 1.2, Facilities Objectives, is evaluated and presented in Table *G-6.*

A rating of red is assigned to the *Overall Rating* for those alternatives resulting in no additional CVNs (one existing CVN) and yellow is assigned to the *Overall Rating* for those alternatives resulting in one additional CVN (a total of two CVNs) for the reasons discussed below.

Additional dredging would be required at PSNS CVN berths under all alternatives except the No Action Alternative. All CVN berths at PSNS are currently dredged to meet NAVSEA requirements under the CVN sea chests, but are not dredged under the entire length of the ship (see depth requirements specified in DON 1995 and DON 1997b, 1997d). A Military Construction Project (MILCON) is currently being prepared to dredge those berths for their complete lengths. A rating of yellow is assigned to Alternatives One and Five to clearly show that once the required construction for one CVN is accomplished, the work required to homeport a second CVN encompasses minor berth utility improvements.

The current pier at PSNS is only marginally acceptable to continue as a CVN home port due to structural design and overall dimensions (DON 1995b). A MILCON project is currently being developed to correct these deficiencies and results in a red rating for the factor *Berth* under Alternatives Two, Three, Four, and Six. Alternatives One and Five have a yellow rating for the same factor to clearly show that once one CVN is accommodated at a new pier, homeporting a second CVN requires only minor modifications, primarily utility improvements.

The factor Berth *Utilities* is rated yellow for all Alternatives excepting Alternative Six to reflect the requirement to improve the amount of upland utilities in the west end of the Shipyard. Alternative Six is rated red in this factor, reflecting the requirements to improve the utilities for two homeported CVNs plus the continued presence (electrical demand) of all four AOEs.

Because all available berths are currently being utilized, addition of any CVNs at PSNS would necessitate relocation of existing homeported ships. Therefore, the relocation of at least two of the AOEs is a necessary assumption for all alternatives involving addition of CVNs to PSNS, except the No Action Alternative.

2.2.3 Maintenance

All items needed to support carrier maintenance or repair are available at PSNS. Each of the factors listed in section 1.3, Maintenance Objectives, is evaluated in Table G-7. A rating of green is assigned for all alternatives.

2.2.4 QOL

Recreational facilities at PSNS include four playing fields, tennis courts, bowling alley, gymnasium, and an auto hobby shop. A fleet recreational facility is currently under construction. Additional recreational opportunities are available to the military at Naval Submarine Base (SUBASE) Bangor, 30 minutes away by public transit, although availability is limited since current demand from SUBASE personnel for these facilities is very high.

Additional recreational facilities are available throughout Kitsap County including privately- or semi-privately owned facilities and others operated by state, county, or city governments.

1

Table G-5. Operations and Training Factors for PSNS Bremerton

Factors	Alt 1 (2 CVN)	Alt 2 (1 CVN)#	Alt 3 (1 CVN)#	Alt 4 (1 CVN)#	Alt 5 (2 CVN)*	Alt 6 (2 CVN)#
Access to Sea	Y	Y	Y	Y	Y	Y
Proximity to Air Wing	Y	Y	Y	Y	Y	Y
Proximity to Battle Group	Y	Y	Y	Y	Y	Y
Air-to-Ground Weapons Delivery	Y	Y	Y	Y	Y	Y
At-Sea Tactical Ranges	Y	Y	Y	Y	Y	Y
Opposing Forces/Electronic Warfare	Y	Y	Y	Y	Y	Y
Fleet Carrier Qualifications	Y	Y	Y	Y	Y	Y
Training Command Qualifications	Y	Y	Y	Y	Y	Y
Overall Rating	Y	Y	Y	Y	Y	Y

2

Table G-6. Facilities Factors for PSNS Bremerton

Factors	Alt 1 (2 CVN)	Alt 2 (1 CVN)#	Alt 3 (1 CVN)#	Alt 4 (1 CVN)#	Alt 5 (2 CVN)*	Alt 6 (2 CVN)#
Turning Basin	Y				Y	
Berth	Y				Y	
Berth Utilities	Y	Y	Y	Y	Y	
Warehouse						
Parking					Y	
Overall Rating	Y				Y	

3

Table G-7. Maintenance Factors for PSNS Bremerton

Factors	Alt 1 (2 CVN)	Alt 2 (1 CVN)#	Alt 3 (1 CVN)#	Alt 4 (1 CVN)#	Alt 5 (2 CVN)*	Alt 6 (2 CVN)#
Cost of Top Side Maintenance						
Cost of Propulsion Plant Maintenance						
Depot Maintenance Facility						
Dry Dock						
Crane Support						
Laydown Area						
Overall Rating						

4

Table G-8. QOL Factors for PSNS Bremerton

Factors	Alt 1 (2 CVN)	Alt 2 (1 CVN)#	Alt 3 (1 CVN)#	Alt 4 (1 CVN)#	Alt 5 (2 CVN)*	Alt 6 (2 CVN)#
Family separation	Y	Y	Y	Y	Y	Y
Career/advancement opportunity						
Living and working environment						
Cost of living						
Schools						
Housing						Y
Military shopping						
Recreational opportunities						
Medical and dental care facilities						
Commuting and parking					Y	
Overall QOL Rating	Y	Y	Y	Y	Y	

* 2 AOEs located at PSNS.
\# 4 AOEs located at PSNS.

Community support facilities at PSNS Bremerton are considered adequate for the number of sailors currently stationed on PSNS homeported ships. PSNS has five high-rise barracks with a capacity of 1,775 beds. A chapel, family service center, military clubs, crafts shop and a child care center are at PSNS. Additional community support facilities are available to the military community at SUBASE Bangor.

Each of the factors listed in section 1.4, QOL Objectives, is evaluated and presented in Table G-8.

An *Overall Rating* of yellow is provided to those alternatives resulting in one additional CVN (a total of two CVNs at PSNS, except Alternative Six) due to increased family separation necessitated by the 6-day round trip transit to the SOCAL operating areas for ship and battle group training. This trip is required a minimum of four times per 2-year operations cycle and results in approximately 24 "extra" days away from home port as compared to a NASNI-based CVN. Alternative Five factor *Commuting and Parking* is rated yellow, reflecting the stress placed on existing facility capacity to accommodate the large number of crewmembers associated with two CVNs plus two AOEs. The same factor in Altema tive Six is rated red to indicate the inability of the Shipyard to accommodate two CVNs plus four AOEs without any construction (no action). Alternative Six factor *Recreational Opportunities* is rated red reflecting the overload of on-base facilities caused by the large customer base associated with two CVNs plus four AOEs.

2.3 NAVSTA EVERETT, WASHINGTON

2.3.1 Operations and Training

Located adjacent to the deep water of Port Gardner Bay, the 117-acre NAVSTA Everett site provides unrestricted access to deepwater passage to the Pacific Ocean via the Strait of Juan de Fuca. In a crisis-response action, the air wing support infrastructure could be rapidly loaded at the pier using Snohomish County Airport as an air-head. With the exception of limited air wing electronic warfare training at Whidbey Island, ship and battle group training must be accomplished in SOCAL.

Each of the factors listed in section 1.1, Operations and Training Requirements, is evaluated and presented in Table G-9.

Alternatives One and Three are rated with N/A to indicate that with no CVNs at NAVSTA Everett, the factors are not germane. With the exception of *Access to **Sea, which is*** green, all other factors are rated yellow to reflect the requirement of an Everett-based CVN to transit to SOCAL for ship and battle group training a minimum of four times per 2-year operations cycle, resulting in approximately 24 "extra" days away from home port as compared to a NASNI-based CVN.

2.3.2 Facilities

The NAVSTA Everett waterfront site is a very compact, functionally-oriented base supporting one CVN and six other combatants. Basic utilities, roadways and the parking area consume much of the remaining land. Community support facilities include barracks, a galley, child care center, an exchange, a recreation center and recreation fields. Construction of NAVSTA Everett is nearly completed.

The existing Carrier Pier at NAVSTA Everett was designed to accommodate the needs of a CVN. Materials handling functions, utilities, and vehicle access are sized for carrier support. Two surface combatants would require relocation to the North Wharf in the event a second CVN were homeported at NAVSTA Everett.

The traffic circulation system for the waterfront site was designed to accommodate parking for approximately 4,600 cars. Six lanes of traffic are available at the main gate and four lanes at the service gate. A parking surplus of 300 to 400 spaces exists at NAVSTA Everett under the current ship homeporting mix. This surplus is on land that was originally intended for a SIMA. Currently, no plans exist to construct a Ship's Intermediate Maintenance Activity (SIMA) at NAVSTA Everett as this function is being performed adequately from a complex of maintenance barges. However, were a SIMA constructed on the proposed site, a parking shortfall would result with present ship homeporting conditions. There are an additional 1,400 long-term fleet parking spaces for deployed personnel at the FSC, but these are of limited use for daily activities due to the distance between the two sites. This deficit would exacerbate the parking demand caused by homeporting a second CVN.

Each of the factors listed in section 1.2, Facilities Objectives, is evaluated and presented in Table G-10.

A rating of green is assigned to Alternatives Two, Five, and Six, reflecting that NAVSTA Everett was designed as a modem CVN homeport. A rating of yellow is assigned to Alternative Four factors, Berth, Berth *Utilities,* and *Parking,* reflecting the need to dredge the west side of Pier A for the second CVN and parts of the Snohomish River to accommodate the relocation of the two displaced surface combatants; the need to add additional 4,160 kV electrical power for the second CVN and add utilities to the North Wharf for the surface combatants; and the need to provide parking for those vehicles displaced from the current parking lot on North Wharf. The *Overall Rating* of yellow for Alternative Four reflects these efforts.

2.3.3 Maintenance

Currently, there are no permanent depot-level ship maintenance facilities available at NAVSTA Everett. There are SIMA barges, management support barges and construction trailers that meet organizational- and intermediate-level maintenance needs. Without the construction of facilities similar in function to the DMF at NASNI, the CVN(s) would be required to move to PSNS for the nearly 6-month PIA. Volume 1, Section 2.7 discusses why construction of a DMF at Everett is considered unreasonable.

Each of the factors listed in section 1.3, Maintenance Objectives, is evaluated and presented in Table G-11.

Table G-9. Operations and Training Factors for NAVSTA Everett						
Factors	*Alt 1 (0 CVN)#*	*Alt 2 (1 CVN)*	*Alt 3 (0 CVN)*	*Alt 4 (2 CVN)*	*Alt 5 (1 CVN)**	*Alt 6 (1 CVN)*
Access to Sea	N/A		N/A			
Proximity to Air Wing	N/A	Y	N/A	Y	Y	Y
Proximity to Battle Group	N/A	Y	N/A	Y	Y	Y
Air-to-Ground Weapons Delivery	N/A	Y	N/A	Y	Y	Y
At-Sea Tactical Ranges	N/A	Y	N/A	Y	Y	Y
Opposing Forces/Electronic Warfare	N/A	Y	N/A	Y	Y	Y
Fleet Carrier Qualifications	N/A	Y	N/A	Y	Y	Y
Training Command Qualifications	N/A	Y	N/A	Y	Y	Y
Overall Rating	**N/A**	**Y**	**N/A**	**Y**	**Y**	**Y**

2

Table G-10. Facilities Factors for NAVSTA Everett						
Factors	*Alt 1 (0 CVN)#*	*Alt 2 (1 CVN)*	*Alt 3 (0 CVN)*	*Alt 4 (2 CVN)*	*Alt 5 (1 CVN)**	*Alt 6 (1 CVN)*
Turning Basin	N/A		N/A			
Berth	N/A		N/A	Y		
Berth Utilities	N/A		N/A	Y		
Warehouse	N/A		N/A			
Parking	N/A		N/A	Y		
Overall Rating	**N/A**		**N/A**	**Y**		

3

Table G-11. Maintenance Factors for NAVSTA Everett						
Factors	*Alt 1 (0 CVN)#*	*Alt 2 (1 CVN)*	*Alt 3 (0 CVN)*	*Alt 4 (2 CVN)*	*Alt 5 (1 CVN)**	*Alt 6 (1 CVN)*
Cost of Top Side Maintenance	N/A		N/A			
~~Cost of Propulsion Plant Maintenance~~	~~N/A~~	Y	~~N/A~~	Y	Y	Y
~~Depot Maintenance Facility~~	~~N/A~~		~~N/A~~			
~~Dry Dock Availability~~	~~N/A~~		~~N/A~~			
~~Crane Support~~	~~N/A~~		~~N/A~~			
~~Laydown Area~~	~~N/A~~	Y	~~N/A~~		[redacted]	[redacted]

Note: 1. Goes to green upon resolution of cross-sound transportation.

4

Table G-12. QOL Factors for NAVSTA Everett						
Factors	*Alt 1 (0 CVN)#*	*Alt 2 (1 CVN)*	*Alt 3 (0 CVN)*	*Alt 4 (2 CVN)*	*Alt 5 (1 CVN)**	*Alt 6 (1 CVN)*
Family separation	N/A		N/A			
Career/advancement opportunity	N/A		N/A			
Living and working environment	N/A		N/A	Y		
Cost of living	N/A		N/A			
Schools	N/A		N/A	Y		
Housing	N/A		N/A			
Military grocery and retail shopping	N/A		N/A			
Recreational opportunities	N/A		N/A	Y		
Medical and dental care facilities	N/A		N/A			
Commuting and parking	N/A		N/A	Y		
Overall QOL Rating	**N/A**		**N/A**			

Notes: 1. Becomes yellow upon solution of cross-sound transportation.
2. Becomes yellow upon construction of additional PPV housing as well as resolution of cross-sound transportation issue.

\# 4 AOEs located at NAVSTA Everett.
* 2 AOEs located at NAVSTA Everett.

Alternatives Two, Four, Five, and Six factor *Cost of Propulsion Plant Maintenance* is assigned a rating of yellow reflecting the added expense involved with transporting the crew to PSNS, the cost of which has to be borne out of maintenance funding.

A rating of red for the factors *Depot Maintenance Facility* and *D y Dock Availability* is assigned to all Alternatives reflecting the absence of these items at NAVSTA Everett.

Alternatives Two, Five, and Six factor *Laydown Area* is rated yellow. Marginally sufficient laydown area exists to accommodate maintenance in the proximity of Pier A (the CVN pier) for one CVN. The same factor is rated red for Alternative Four, which contains two CVNs at Everett.

If an acceptable solution is found to reduce the amount of time the crew is separated from their families while the ship is in PSNS undergoing PIA, the family separation issue would be resolved and the *Overall Rating* assigned would be green (see DON 1997c).

2.3.4 QOL

The majority of housing demand generated by homeporting additional CVNs would be met by private-sector housing development. The Navy, as a limited partner, has developed nearly 200 new units of housing near the FSC. Plans are in the final stages, which will add an additional 400 units. This project targets junior enlisted families.

Support facilities currently existing or planned for NAVSTA Everett by 1999 are located at both the Waterfront site and the FSC and include medical and dental clinics, enlisted barracks and Bachelor Officers Quarters (BOQ), galley, child development center, retail commissary and exchange, clubs, auto hobby shop and a chapel.

All alternatives are assigned a red rating for the factor *Family Separation*. A CVN homeported at NAVSTA Everett, just like one homeported at PSNS, must transit to SOCAL for ship and battle group training (see Operations and Training discussion, section 1.1). Additionally, and unlike a CVN homeported at PSNS, NASNI, or Pearl Harbor, the Everett-based CVN is scheduled to spend approximately 6 months every 2 years at PSNS undergoing PIA. This combination of "extra" time away from home is reflected in the *Overall Rating* for all Alternatives.

The Navy is currently attempting to devise Methods for transporting the 900 person crew across Puget Sound on a daily basis while the CVN is in PSNS undergoing PIA with the goal of reducing the time the crew is away from their families. The extent to which this effort meets with success is reflected in the notes at the bottom of Tables G-11 and G-12.

Each of the factors listed in section 1.4, QOL Objectives, is evaluated and presented in Table G-12.

Alternative Four factor *Living and Working Environment is* assigned a yellow rating, reflecting the anticipated constraints on the crews of two CVNs and the existing six surface combatants currently homeported at the NAVSTA. These constraints would be caused by the compactness of the NAVSTA (117 acres) and the physical inability to expand. The factor Schools is assigned a yellow rating, reflecting the approximately 741 school-aged children that an additional CVN crew would bring to area school systems already quite full. The factor *Recreational Opportunities* is rated yellow, reflecting the overloading of the recreational facility that would likely occur with the addition of a second CVN. The four ball fields at the waterfront site would be marginally adequate. The *Commuting and Parking* factor is rated yellow, reflecting the requirement to construct a multi-story parking structure to accommodate the vehicles displaced from North Wharf.

The ship would need to be moved to a new homeport if an acceptable solution is not identified that would reduce the amount of time the CVN crew is away from NAVSTA Everett during the nearly 6-month PIA, occurring every 2 years. Currently, the only available method requires transporting crew in buses and ferries, resulting in a 2-hour one-way commute. This is an adverse factor on sailor QOL.

2.4 PHNSY, PEARL HARBOR, HAWAII

2.4.1 Operations and Training

Carrier and battle group training are accomplished predominately in SOCAL training areas, a transit of approximately 6 days at the most efficient speed for a CVN. Were a CVN to be homeported in Pearl Harbor, it is anticipated that each of the approximately four training deployments per 2-year operational cycle would include a 6-day in-port period in San Diego to load and off-load the air wing and capture the economies of concentrated school house training available in the area, as opposed to the more expensive method of sending individual crew members from Hawaii via commercial airlines. This would result in approximately 72 "extra" days away from home port as compared to a CVN homeported at NASNI or the 24 "extra" days for a Puget Sound-homeported CVN.

Because the carrier must transit to San Diego at the start of its overseas deployment to embark the air wing, it will have 14 fewer days on station than a San Diego-based carrier and eight fewer than a Puget Sound-based carrier.

In Table G-13, Alternatives One, Two, Four, and Six are rated "not applicable (N / A)" for all factors because they do not apply to the condition of "no CVN." Alternatives Three and Five are rated red for all factors as discussed below.

The factor ***Access to Sea*** is assigned a red rating due to the extensive amount of dredging that would be required in the channel to give the CVN unrestricted or nearly unrestricted access to the sea.

Absence of the sophisticated tracking and tactically challenging training ranges that are accessible from SOCAL makes it unsatisfactory to tram either the ship-air wing team or the carrier battle group in Hawaii. The alternative requires the ship to steam to SOCAL where it would embark the air wing, join with other battle group ships, and conduct required training.

1

Table G-13. Operations and Training Factors for PHNSY Pearl Harbor

Factors	*Alt 1 (0 CVN)*	*Alt 2 (0 CVN)*	*Alt 3 (1 CVN)*	*Alt 4 (0 CVN)*	*Alt 5 (1 CVN)*	*Alt 6 (0 CVN)*
Access to Sea	N/A	N/A		N/A		N/A
Proximity to Air Wing	N/A	N/A		N/A		N/A
Proximity to Battle Group	N/A	N/A		N/A		N/A
Air-to-Ground Weapons Delivery	N/A	N/A		N/A		N/A
At-Sea Tactical Ranges	N/A	N/A		N/A		N/A
Opposing Forces/Electronic Warfare	N/A	N/A		N/A		N/A
Fleet Carrier Qualifications	N/A	N/A		N/A		N/A
Training Command Qualifications	N/A	N/A		N/A		N/A
Overall Rating	**N/A**	**N/A**		**N/A**		**N/A**

2

Table G-14. Facilities Factors for PHNSY, Pearl Harbor

Factors	*Alt 1 (0 CVN)*	*Alt 2 (0 CVN)*	*Alt 3 (1 CVN)*	*Alt 4 (0 CVN)*	*Alt 5 (1 CVN)*	*Alt 6 (0 CVN)*
Turning Basin	N/A	N/A	Y	N/A	Y	N/A
Berth	N/A	N/A	Y	N/A	Y	N/A
Berth Utilities	N/A	N/A	Y	N/A	Y	N/A
Warehouse	N/A	N/A		N/A		N/A
Parking	N/A	N/A	Y	N/A	Y	N/A
Overall Rating	N/A	N/A	Y	N/A	Y	N/A

3

Table G-15. Maintenance Factors for PHSNY, Pearl Harbor

Factors	*Alt 1 (0 CVN)*	*Alt 2 (0 CVN)*	*Alt 3 (1 CVN)*	*Alt 4 (0 CVN)*	*Alt 5 (1 CVN)*	*Alt 6 (0 CVN)*
Cost of Top Side Maintenance	N/A	N/A	Y	N/A	Y	N/A
Cost of Propulsion Plant Maintenance	N/A	N/A	Y	N/A	Y	N/A
Depot Maintenance Facility	N/A	N/A	Y	N/A	Y	N/A
Dry Dock Availability	N/A	N/A		N/A		N/A
Crane Support	N/A	N/A		N/A		N/A
Laydown Area	N/A	N/A		N/A		N/A
Overall Rating	**N/A**	**N/A**	**Y**	**N/A**	**Y**	**N/A**

4

Table G-16. QOL Matrix for PHNSY Pearl Harbor

Factors	*Alt 1 (0 CVN)*	*Alt2 (0 CVN)*	*Alt3 (1 CVN)*	*Alt 4 (0 CVN)*	*Alt 5 (1 CVN)*	*Alt 6 (0 CVN)*
Family separation	N/A	N/A		N/A		N/A
Career/advancement opportunity	N/A	N/A		N/A		N/A
Living and working environment	N/A	N/A		N/A		N/A
Cost of living	N/A	N/A	Y	N/A	Y	N/A
Schools	N/A	N/A	Y	N/A	Y	N/A
Housing	N/A	N/A		N/A		N/A
Military grocery and retail shopping	N/A	N/A		N/A		N/A
Recreational opportunities	N/A	N/A		N/A		N/A
Medical and dental care facilities	N/A	N/A		N/A		N/A
Commuting and parking	N/A	N/A		N/A		N/A
Overall QOL Rating	**N/A**	**N/A**		**N/A**		N/A

Basing an aircraft carrier in Pearl Harbor would also remove it from consideration for use as a landing qualification platform for the Naval Air Training Command or for use by the various West Coast-based Fleet Readiness Squadrons, unless additional "extra" days away from home port were imposed on the crew so that the ship could operate off the California coast where suitable divert air fields are available with the required good flying weather/sea conditions.

Examination of Pearl Harbor as a potential homeporting location should not be accomplished without also considering the question of where the air wing assigned to the CVN would be located. There are no airfields in Hawaii capable of permanently basing an air wing.

An air wing is made up of a mix of approximately 75 aircraft with 2,039 associated personnel. When an aircraft carrier is in port, its air wing is normally based onshore, dispersed among several naval air stations, e.g., the F/A-18 aircraft are at NAS Lemoore, the S-3 aircraft are at NAS North Island, etc. The practice of grouping the squadrons onshore by type of aircraft has proven to be much more efficient than grouping the squadrons as air wings of mixed aircraft types. This is true for several reasons. There is a measurable synergy achieved by grouping warfare specialists together as they develop and refine warfare tactics, it facilitates intratype-squadron (squadrons with same type, model, and series aircraft) training exercises, and encourages exchange of ideas and lessons learned. In addition, substantial dollar savings are achieved by collocating the aircraft maintenance and supply functions at a single site.

Basing a carrier air wing in Hawaii is neither cost effective nor operationally efficient. As a result of both costs, and operational considerations, the Navy's preference would be to continue basing Pacific Fleet carrier air wings in the continental United States (CONUS), by type aircraft (DON 1997a).

Each of the factors listed in section 1.1, Operations and Training Requirements, is evaluated and presented in Table G-13.

A rating of red is assigned to the ***Overall Rating*** for alternatives with one CVN, as the number and duration of CVN trips necessary between Hawaii and SOCAL for training would substantially exceed those associated with a West Coast home port location.

24.2 Facilities

Berths B2 and B3 are adjacent berths located in the PHNSY within the CIA. Street access is provided from Sixth Street and Avenue E, which are industrial two-lane roadways. While various areas for parking and laydown of equipment are available at PHNSY, areas of any substantial size are approximately 0.25 mile away.

Seven warehouses are available for use in PHNSY. Four smaller warehouses are projected for demolition in the near term, providing several areas for potential use, roughly 0.5 acre each. B2/3 has existing potable water, compressed air and wastewater hookups. Steam and electricity are provided by portable units (steam plants and mobile utility support equipment [MUSE] substations) capable of meeting CVN requirements. Electrical upgrades planned within 5 years, and currently under negotiation with the Hawaii Electric Company (HECO), would provide 4,160-volt power to the piers on a permanent basis.

Each of the factors listed in section 1.2, Facilities Objectives, is evaluated and presented in Table G-14.

Alternatives Three and Five factor *Turning Basin* is assigned a yellow rating due to the need to dredge the entire area depicted in Figure 2-10 (Volume 1). The factor *Berth* is assigned a yellow rating due to the need to dredge alongside Berths B2/3 for the entire length of a CVN. The factor *Berth Utilities* is assigned a yellow rating, reflecting the need to upgrade from MUSE units that now supply power to permanent 4,160-kV power and to improve shore steam, sewer, sea water pumping, and pure water production capacities. Parking is assigned a yellow rating reflecting the need to construct a parking structure.

The Overall Rating for these two alternatives is yellow, reflecting the existing shortcomings of the Shipyard to provide the requisite CVN facilities.

2.4.3 Maintenance

Piers B2 and B3 are used primarily by the shipyard for vessels under repair. On occasion, these piers are also used for overflow berthing from NAVSTA Pearl Harbor, but because of distance from the center of NAVSTA Pearl Harbor, it is an undesirable transient berth and not heavily used for that purpose. B2/3 can be used without impairing use of Dry Dock No. 1, and can with modifications accommodate a CVN.

Additional maintenance facilities are needed to support CVN PIAs and DPIAs at PHNSY. Berths B2 and B3 are where CVN PIA maintenance would be conducted. With the additional maintenance facilities, and augmentation of this workforce from other qualified shipyards, PHNSY would be able to support the maintenance needs of a CVN and still execute its primary mission of providing maintenance on U.S. Pacific Fleet supply ships and nuclear-powered submarines.

Each of the factors listed in section 1.3, Maintenance Objectives, is evaluated and presented in Table G-15.

Alternatives Three and Five factors *Cost of Top Side Maintenance* and *Cost of Propulsion Plant Maintenance* are rated yellow, reflecting the need to import the maintenance force (varying from specialized groups for top side maintenance to nearly all for propulsion plant maintenance) from CONUS. The factor *Depot Maintenance Facility* is rated yellow, reflecting the need to construct a CIF and to modify some existing structures.

The Overall Rating for these two alternatives is yellow, reflecting the shortcomings delineated above.

2.4.4 QOL

With the exception of the heavily weighted factor *Family Separation, the* Quality of Life rating for PHNSY is generally excellent. The living and working environment are particularly pleasing with very adequate military grocery and retail shopping provided from several military installations spread throughout Oahu. Recreation opportunities abound at both civilian and military facilities. On-base housing is oversubscribed for both bachelors and families. The civilian housing market has adequate capacity to absorb a CVN's off-base demand. Commuting and parking are generally good with expected slow-downs during peak hours. On-base support facilities, such as medical and dental care, are good.

Presently, the total Navy bachelor housing requirement is 5,347 units, while the Navy family housing requirement is 9,712 units. With 4,455 bachelor housing units and 9,302 family housing units available, the deficit for bachelor housing is 892 units and the deficit for family housing is 410 units. New housing by the PPV program will probably be provided for junior enlisted personnel.

The occupancy rate for bachelor housing is 75 percent for junior and senior enlisted personnel. This is partially due to a Navy policy of maintaining unit integrity. The occupancy rate for bachelor officers is nearly 100 percent with only 20 units available for permanent residents. 180 units are available for transient officers. The total occupancy rate for family housing is 90 percent, partially because of renovations.

Each of the factors listed in section 1.4, QOL Objectives, is evaluated and presented in Table G-16.

Alternatives Three and Five factor ***Family** Separation* is rated red, reflecting the increased incidence of family separation necessitated by having to use the SOCAL operating and training areas for ship and battle group training. This impact on crew quality of life is strong enough to cause the "overall" rating to also be red. Compared to an NASNI-based CVN, a Pearl Harbor-based CVN would spend 72 more days per 2-year operating cycle away from home for training reasons. Compared to a Puget Sound-based CVN, a Pearl Harbor-based CVN would spend 48 more days per 2-year operating cycle away from home for the same reason.

To some degree, this absence is balanced on the grand scale by the possibility of not having to leave home port once every 6 years for a 10-month period to undergo a Docking Incremental Phased Availability (DPIA). Comparisons of this "advantage" are difficult. An Everett-based CVN must leave home port and go to PSNS for its DPIA as well as its PIAs. The crew, however, have the option to commute to their homes on the east side of Puget Sound on a daily basis. The bachelor members of the crew can live either on the ship (as they normally do) or in the Bachelor Quarters at PSNS. A NASNI-based CVN does its PIAs at North Island and its DPIAs at PSNS. The family members of the crew will have the option of moving their families to Bremerton at government expense. The NASNI CVN bachelors will do the same thing the Everett-based bachelors do when at PSNS for maintenance.

The factor School in both Alternatives Three and Five is assigned a yellow rating, reflecting the impact on an already crowded school system.

The Cost of Living factor for both Alternatives Three and Five reflect the added expense associated with living on an island remote from the continental United States where nearly everything must be imported.

3.0 COMPARISON OF ALTERNATIVES

Two tables are presented in this section to help graphically capture a comparison of the "factors" associated with homeporting a CVN(s). Table G-17 presents a comparison by home port location; Table G-18 presents a comparison by alternative. In both cases, an "overall" comparison is provided.

3.1 NASNI

Prior analysis by the Navy (DON 1997a) has shown that the maximum number of homeported CVNs that can be accommodated without severely impacting QOL is three. A fourth homeported CVN exceeds the area's ability to provide suitable housing and brings extreme traffic congestion to key intersections in the City of Coronado.

The immediate proximity of the SOCAL training areas and availability of air wing training ranges throughout the southern part of the West Coast are ideal for any number of CVNs homeported at NASNI.

Completion of construction in mid-1998 will provide a new wharf and associated dredging for the BRAC-directed CVN that will arrive in August 1998. Additional wharf and dredging will be required for a second homeported CVN and is reflected in the red rating. Minor effort is required to then turn the existing Transient Berth into an acceptable CVN homeporting berth, hence the yellow rating. By the time the BRAC-directed CVN arrives, all maintenance construction projects now underway will be finished and NASNI will be fully capable of performing PIAs. The work force of necessity will be imported from a nuclear-capable shipyard. The cost of importing this uniquely qualified labor moves the maintenance rating to yellow to more accurately compare NASNI's depot maintenance operation to that of PSNS.

The QOL ratings for all three CVN alternatives are yellow to reflect the family separation caused by the necessity to travel to PSNS once every 6 years for a 10-month DPIA.

The *Overall Ratings* are reflective of the cumulative appraisal of the four objective categories and in this case are green for one CVN, yellow for two and/or three CVNs.

3.2 PUGET SOUND NAVAL SHIPYARD

Prior analysis by the Navy (DON 1997a) has shown that the maximum number of homeported CVNs that can be accommodated at PSNS without severely impacting QOL is two. When addressing how many CVNs could be homeported at PSNS, it should be noted at times there could be three CVNs in port simultaneously: two "homeported" and one "transient" undergoing maintenance (PIA or DPIA). The presence of three CVNs would stress the QOL aspects of the shipyard to its maximum.

The requirement for a PSNS-homeported CVN to travel to the SOCAL operating areas to accomplish battle group and air wing strike training results in a yellow rating for any number of CVNs. This round trip of 6 days duration is required 12 times every 6-year cycle.

Homeport Site	Number of CVNs	Operations/ Training	Existing Facilities	Maintenance	Quality of Life	Overall
NASNI	1	G	G	Y	Y	G
NASNI	2	G	R	Y	Y	Y
NASNI	3	G	Y	Y	Y	Y
PSNS	1	Y	R	G	Y	Y
PSNS	2	Y	Y	G	Y	Y
NAVSTA/ Everett	1	Y	G	R	R	R
NAVSTA/ Everett	2	Y	Y	R	R	R
PHNSY	1	R	Y	Y	R	R

G: Green, satisfies homeporting requirement objectives
Y: Yellow, satisfies homeporting requirement objectives with moderate effort
R: Red, satisfies homeporting requirement objectives only with extensive effort/cannot satisfy

Table G-17. Home Port Comparison by Site and Number of CVNs

	ALTERNATIVES					
	One	Two	Three	Four	Five	Six (No Action)
NASNI	3	3	3	2	1	2
PSNS	2	1	1	1	2	2
NAVSTA Everett	0*	1	N/A	2	1	1
PHNSY	N/A	N/A	1	N/A	1	N/A
Overall						

Note: Table is summary of how well each alternative meets the objectives and requirements as analyzed in Appendix G

Number (0, 1, 2, 3) in each cell denotes number of CVNs at that location for that alternative

N/A: Denotes no CVNs present for that alternative

*: Denotes 4 AOEs would be moved from PSNS to Everett

G: Green, satisfies homeporting objectives

Y: Yellow, satisfies homeporting objectives with moderate eff ort

R: Red, satisfies homeporting objectives only with extensive effort/cannot satisfy

Table G-18. Summary Comparison of Alternatives Based on Objectives and Requirements

Two major projects are required to bring PSNS into conformance with existing CVN homeporting requirements. The magnitude of these projects is reflected in the red rating assigned and compares with the red rating awarded NASNI for its project.

The ability to perform depot level maintenance is PSNS's strength. Additionally, with the completion of this project, routine and frequent short-term availability maintenance could be performed while the CVN is at its home port berth. The green rating reflects the economics of homeporting a CVN at PSNS from the maintenance perspective.

The need to perform training in SOCAL results in frequent separations of navy-member and family. This QOL impact is reflected in a yellow rating for CVNs homeported anywhere in the Pacific Northwest, in this specific case: PSNS. The homeporting of a second CVN at PSNS would of necessity cause the relocation of the AOEs currently homeported there. From a QOL point of view, the homeporting of two CVNs, the presence of a third CVN undergoing maintenance, and the continued homeporting of AOEs is not feasible. The presence of three CVNs alone would make the commuting and parking rating red.

The *Overall Ratings* are reflective of the cumulative appraisal of the four objective categories and in the case of PSNS are both yellow, a result of training and QOL impacts.

3.3 NAVAL STATION EVERETT

Prior analysis by the Navy (DON 1997a) has shown that the maximum feasible number of homeported CVNs that can be accommodated at NAVSTA Everett is two. Construction projects including wharf, utilities, and dredging would be required as well as multiple QOL projects including a parking garage and recreation facility expansion if more than two CVNs were homeported there. There is no land available to expand the naval station to accommodate the increased QOL demand associated with more than two CVNs.

The requirement for a NAVSTA Everett-homeported CVN to travel to the SOCAL operating areas to accomplish battle group and air wing strike training results in a yellow rating for any number of CVNs. This round trip of 6 days duration is required 12 times every 6-year cycle.

NAVSTA Everett was designed and constructed to home port a CVN. The adequacy of this design and construction is reflected in the green rating awarded in the category of *existing facilities*. The addition of a second CVN would require utilities upgrades, parking garage, and dredging of the west side of Pier A.

No provisions were included in the design of NAVSTA Everett for nuclear propulsion plant maintenance. Consequently, the homeported CVN must travel to PSNS three times every 6 years for either PIAs or a DPIA. This lack of propulsion plant maintenance capability is reflected in the red rating for any number of CVNs that might be homeported at NAVSTA Everett.

The satisfaction of the presently homeported CVN with the QOL at NAVSTA Everett is well documented (DON 1997a). Nevertheless, the impending maintenance availabilities at PSNS will result in family relocations at the maximum or long work days at the minimum because the one-way trip across Puget Sound takes a minimum of two hours using the existing Washington State Ferry System. For this reason, red ratings have been assigned to the QOL category for NAVSTA Everett.

The ***Overall Rating*** for either alternative number of CVNs **at** NAVSTA Everett is red, reflecting the anticipated family separation occasioned by both the necessity to transit to SOCAL for training and the need to move to PSNS to perform propulsion plant maintenance.

3.4 PEARL HARBOR NAVAL SHIPYARD

Prior analysis by the Navy (DON 1997a) has shown that the maximum feasible number of homeported CVNs that can be accommodated at Pearl Harbor is one. The specific site for the CVN would be inside the Controlled Industrial Area at the naval shipyard.

Neither a CVN's air wing nor adequate training ranges exist in Hawaii. A discussion of the training ranges is in section 2.4.1. As a result of these inadequacies, a rating of red is assigned.

Dredging of the channel, the turning basin, and the berthing site, as well as structural and utility upgrades to the berth would be required. Additionally, supporting facilities such as communications, administration, warehouse and storage would be required. Drydock #4 is capable of supporting repairs of a CVN. Performance of DPIAs in the dry dock would require structural and utility upgrades.

Most facilities exist at PHNSY to perform PIAs. With the exception of a CIF, relatively minor additions or modifications to existing facilities would be required to accommodate the I reased scope of work associated with a CVN versus that of a submarine. The additional workforce required would have to be imported for the most part. For this reason, a rating of yellow was assigned. The work force required to perform DPIAs would also have to be imported, however for a much longer period.

The ***Overall Rating*** is reflective of the cumulative appraisal of the four objective categories and in the case of PHNSY is red, a result of training and QOL impacts.

3.5 COMPARISON OF HOME PORT ALTERNATIVES

Table G-18 is a summary of how well each alternative meets the objectives and requirements as analyzed in this appendix.

3.5.1 Alternative One

The ***Overall Rating*** for Alternative One is yellow. Alternative One is subsumed as part of the Preferred Alternative.

3.5.2 Alternative Two

The ***Overall Rating*** for Alternative Two is red, reflecting the absence of a nuclear propulsion plant maintenance capability at NAVSTA Everett and the consequent need to address the cross-sound transportation issue. Alternative Two is also subsumed as part of the Preferred Alternative.

3.5.3 Alternative Three

The *Overall Rating* for Alternative Three is red, reflecting the Quality of Life impact brought about by the requirement for a Pearl Harbor-based CVN to transit to the West Coast four times each 2-year operating cycle for ship and battle group training.

3.5.4 Alternative Four

The Overall Rating for Alternative Four is red, reflecting the absence of a nuclear propulsion plant maintenance capability at NAVSTA Everett as well as the need for comprehensive construction efforts in the areas of parking, pier utilities, and dredging.

3.5.5 Al temative Five

The Overall Rating for Alternative Five is red, reflecting the NAVSTA Everett shortcomings as well as the requirement for a Pearl Harbor-based CVN to transit to the West Coast for training.

3.5.6 Alternative Six

The *Overall* Rating for Alternative Six, the "no action" alternative, is red, reflecting the consequences of trying to homeport additional CVNs without providing the capabilities and facilities required to do so. Specifically, NASNI would have to use the existing "transit" berth as a homeport berth, which is an operationally unsatisfactory situation. PSNS would have to homeport an additional CVN without the requisite facility and infrastructure improvements already required for the existing homeported CVN. NAVSTA Everett would have to continue to wrestle with the PIA maintenance/cross-sound transportation issue and its impact on Quality of Life.

REFERENCES

DON. 1997a. *Homeport Analysis for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the* U.S. *Pacific* ***Fleet. Comman*** der, Naval Air Force, U.S. Pacific Fleet.

DON. 1997b. Draft Major CVN Homeporting Criteria. David Curfman, Specialist Assistant for Wharfs and Waterfronts, Naval Facilities Engineering Command.

DON. 1997c. Cross Sound Transportation in Support of USS ABRAHAM LINCOLN 1999 Planned Incremental Availability. COMNAVAIRPAC ACOS PACNORWEST Memo 19 December.

DON. 1995. Letter, Commander, Naval Sea Systems (03D3/242) (3 Jan 95).

1

APPENDIX H

CVN 68-CLASS WATER DEPTH REQUIREMENTS

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
2531 JEFFERSON DAVIS HIGHWAY
ARLINGTON VA 22242-5160

IN REPLY REFER TO
11460
Ser 03D3/242
3 Jan 95

From: Commander, Naval Sea Systems Command
TO: Chief of Naval Operations (N44)
Chief of Naval Operations (N88)

Subj: CVN 68 CLASS WATER DEPTH REQUIREMENTS

Raf: (a) NAVSEA ltr 11460 Ser PMS312/792 of 30 Apr 91
(b) NAVSEA ltr 11460 Su 03D3/144 of 9 Aug 94
(c) COMNAVAIRLANT ltr 4700 Ser N431F/01400 of 19 May 94

Encl: (1) CVN 68 Class Home Port Water Depth Requirements
(2) CVN 68 Class Shipyard Water Depth Requirements
(3) CVN 68 Class Shallow Water Navigation Improvements

1. NAVSEA has determined the water depth requirements for CVN 68 Class aircraft carriers in home ports, ports of call, and shipyards. The pier and channel depths requirements previously provided in reference (a) are superseded. These water depth requirements augment those previously provided for San Diego in reference (b), and respond to the reference (c) request for Norfolk Naval Shipyard.

2. Enclosure (1) provides water depth requirements for home ports. Attachment (1) of enclosure (1) also applies to ports of call. The ship's mean draft used for home ports corresponds to the limiting displacement and is considered the proper basis for dredging since ft will permit operations of a fully loaded ship. Enclosure (2) [illegible] water [illegible] requirements for shipyards. The ship's mean draft used for shipyards was reduced baaed on the assumption that only 55% of the ship's &ad8 (aircraft, fuel, personnel, stores, etc) would be onboard. Each enclosure describes and quantifies the components that contribute to the CVN 68 Class draft and clearance; the governing depth requirements for the pier, turning basin, inner channel, and outer channel for each home port and shipyard; general tide information for each home port and shipyard; and a graphical representation of the relationship between the number of days of access to the turning basin and inner channel, the length of the tide window, and the dredging project depth for the governing depth requirement of each home port and shipyard.

3. While at the pier, in the turning basin, or in the inner channel of a home port or a port of call, it is recommended that there be a minimum of 50 feet of water depth. While at the pier, in the turning basin, or in the inner channel of a shipyard, it is recommended that there be a minimum of 47 feet of water depth, assuming the ship has been offloaded. Entering a shipyard vi thout of floading should be treated as a port of call. These water depth requirements are governed by the sea chest fouling

Subj: CVN 68 CLASS WATER DEPTH REQUIREMENTS

clearance criterion established as a result of sea chest fouling problems at Norfolk. *Port specific fouling clearance studies can be performed if requested and funded. *Note that this criterion also provides clearance for divers (5 feet) while at the pier. The dredging project depth can be traded off with tides to obtain the necessary water depth in inner channels and turning basins with the corresponding operational restrictions; however, tide tradeoffs cannot be used at piers. *Localized pier dredging in way of sea chests can save 2 feet of dredging costs outside of the . .a chest area; however, operational restrictions may result (e.g. less transit time in tide window and limited diver access) . In ports with large amounts of debris on the bottom, locally dredged areas will tend to collect debris requiring more frequent maintenance dredging.

4. In the outer channel, wave action usually dominates the depth requirements and can have a large variance. A ship motions analysis was performed for the outer channels of San Diego and Mayport to account for the statistical nature of the tides and wave action. The ship motions analyses of the remaining home ports and shipyards will be completed within 6 months after receipt of funding. Dredging to support unrestricted access is clearly unaffordable. Consequently, the selection of a project depth is a tradeoff between cost, operational requirements, and the risk of grounding.

5. Many of the factors that affect channel transit are operational issues such as operating schedule and contingencies; port operations; ship displacement, trim, list, and speed; as well as weather and tides. Actual transit situations will vary and will involve different combinations of these factors. Consequently, a given transit could require more or less water depth. Enclosure (3) describes efforts underway or proposed to improve onboard shallow water navigation aids that predict ship's motion, provide real time channel condition measurement, improve ship's draft and attitude indication, and provide a load management system.

6. The NAVSEA point of contact is W. Page Glennie, NAVSEA 03D37, (703) 418-8876.

M. S. FIREBAUGH
Deputy Commander for Engineering

Copy to: (w/encls)
OPNAV (Code N43)
NAVFAC (Code 15)
COMNAVAIRLANT (code N43, N02N)
COMNAVAIRPAC (Code N43, N7N)
CINCLANTFLT (Code N4, N43)
CINCPACFLT (Code NO, N43)
NSWC-CD (Code 1561)
NAVSEA DET PERA CV (code 1824)

CVN 68 CLASS HOME PORT WATER DEPTH REQUIREMENTS

Attachments:

(1) CVN 68 Class Home Port and Ports of Call Draft and Clearance Requirements
(2) CVN 68 Clam Water Depth Requirements for Norfolk Operating Base
(3) Sewell's Point Tide Access, so foot Depth Requirement
(4) CVN 68 Class Water Depth Requirements for San Diego
(5) San Diego Inner Channel Tide Access, so foot Depth Requirement
(6) CVN 68 Class Water Depth Requirements far Everett
(7) Everett Tide Access, so foot Depth Requirement
(8) CVN 68 Class Water Depth Requirements for Bremerton
(9) Rich Passage Tide Access, SO foot Depth Requirement
(10) CVN 68 Class Water Depth Requirements for Mayport
(11) Mayport Tide Inner Channel Access, *SO* foot Depth Requirement

CVN 68 Class Home Port and Ports of Call Draft and Clearance Requirements

Static Draft				
Mean	40.8 ft 103,800 tons (CVN 68-75) 104,200 tons (CVN 76)			- Accounts for: Actual operating condition (+2000 tons) Service life weight growth (+70 tons/year) Unreported weight - Assumes weight is added in best location. - Assumes good ship weight control.
Trim	0.25 degrees	Bow	2.3 ft	- Based on operational experience. Instances of greater trim do occur, but rarely when the [illegible]
		Sea Chest	[illegible]	
		Rudder	2.1 ft	
List	Pier	2 degrees	Bilge Keel 2.3 ft	- Based on operational experience. Instances of greater list do occur, but rarely when the ship is at the limiting displacement.
			Sea Chest 1.4 ft	
	Channel	0 degrees		- Assumed ship is leveled prior to transit. TYCOM confirmation is needed.
Appendages	9 inches			- All of the CVN 68 Class except CVN 70 have discharge sea chest diffusers. - Assumed to be overshadowed by trim.
Salinity & Temperature	0.5 feet (50% salinity reduction & 10° temperature rise)			- This calculation is port, season, and tide specific. - Assumed constant.
Dynamic Draft				
Wind & Waves	Outer Channel		See Note	- This calculation is port specific. - See indiv. port summary sheet for details.
	Inner Channel		0 ft	- Protected harbor.
	Pier & Turning Basin			
Squat	10 kts	Forward	0.9 ft	- Based on wide channel that is 50 ft deep. - Shallower and/or narrower channels and/or higher speeds will require a greater allowance for squat.
		Aft	1.3 ft	
		Sea Chest	1.0 ft	
Heel	1.4 degrees	Bilge Keel	1.6 ft	- Based on operational experience, 10 kts and 10 degrees rudder.
		Sea Chest	0.8 ft	
Clearance				
Fouling	6 ft			- Based on operational experience at NOB and NAVFAC study and applies to soft bottoms and bottoms with loose sea growth. - Assumes diffusers are installed.
Grounding	Soft Bottom		2 ft	- NAVFAC deterministic standard.
	Hard Bottom		3 ft	
	1/100			- Proposed probabilistic standard.

Enclosure (1) Attachment (1)

CVN 68 Class Water Depth Requirements for San Diego

	Pier	Turning Basin	Inner Channel	Outer Channel
Draft	40.8	40.8	40.8	40.8
Trim	0.8	0.8	0.8	2.1
List	1.4	1.4	-	-
Appendages	-	-	-	-
Salinity & Temp (a)	-	-	-	-
Motions (b)	-	-	-	4.2/27.7 (f)
Squat (c)	-	-	1.0	1.3
Heel (d)	-	-	0.8	-
Clearance (e)	6.0	6.0	6.0	2.0
TOTAL	49.0	49.0	49.4	50.4/73.9 (g)

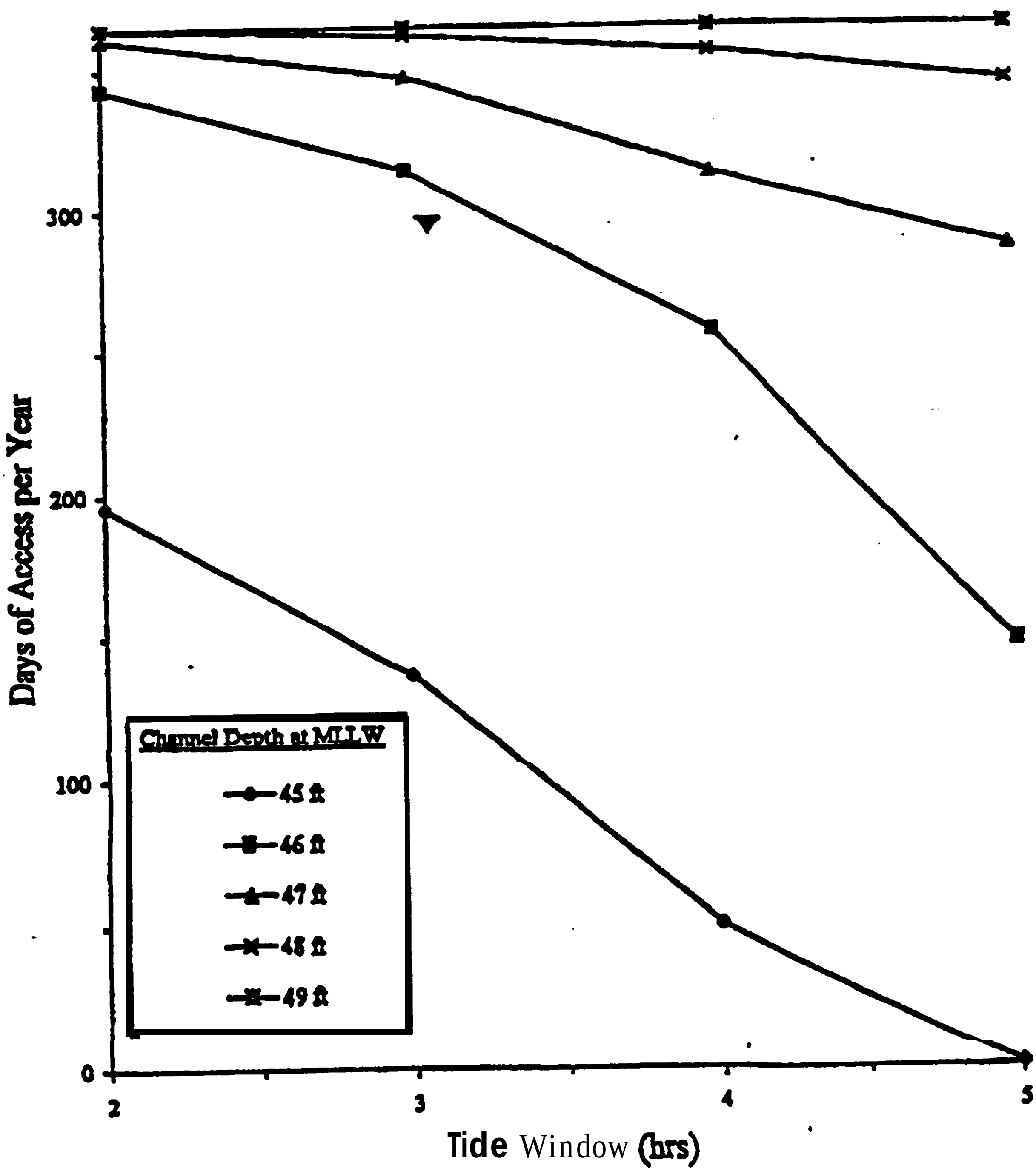
Notes: (a) Salt water port; no correction required.
(b) Unprotected harbor; significant wave action.
(c) Based on wide, 50 ft deep channel; good estimate.
(d) Operational experience.
(e) Standard clearances.
(f) Weighted average and extreme values.
(g) A water depth of 74 feet provides unrestricted access.

San Diego Tide Data

Mean Higher High Water	5.8 feet
Mean Lower Low Water	0.0 feet
Extreme Low Water	-2.0 feet

Enclosure (1)
Attachment (4)

San Diego Inner Channel Tide Access
50 Foot Depth Requirement



Enclosure (1)
Attachment (

CVN 68 Class Water Depth Requirements for Everett

	Pier	Turning Basin	Inner Channel	Outer Channel
Draft	40.8	40.8	40.8	(f)
Trim	0.8	0.8	0.8	
List	1.4	1.4	-	
Appendages	-	-	-	
Salinity & Temp (a)	0.5	0.5	0.5	
Motions (b)	-	-	-	
Squat (c)	-	-	1.0	
Heel (d)	-	-	0.8	
Clearance (e)	6.0	6.0	6.0	
TOTAL	49.5	49.5	49.9	

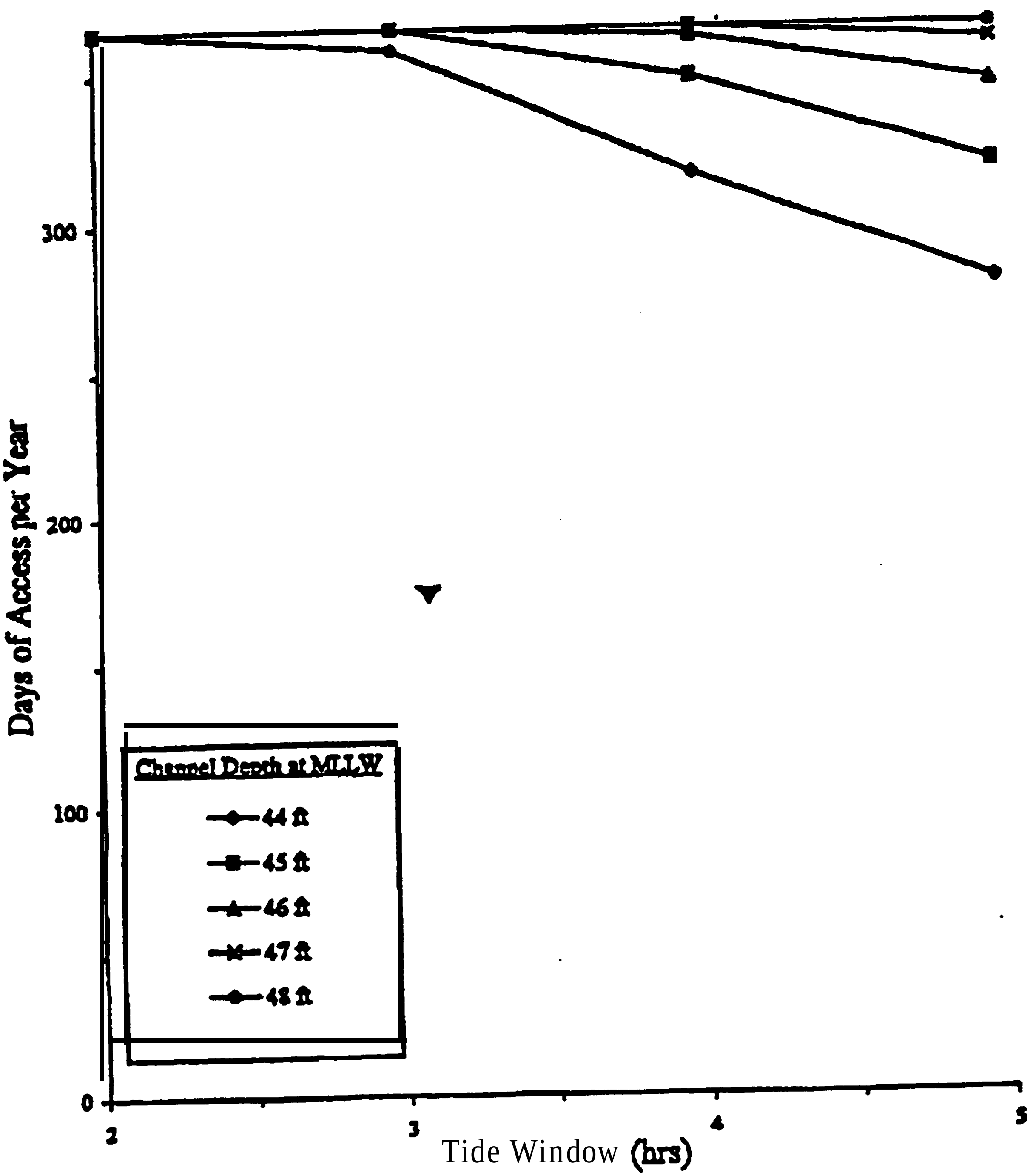
Notes:
(a) Harbor contains fresh water inlet.
(b) Protected harbor; no significant wave action.
(c) Based on wide, 50 ft deep channel; need more information.
(d) Operational experience.
(e) Standard clearances.
(f) Unrestricted outer channel due to deep depth.

Everett Tide Data

Mean Higher High Water	11.1 feet
Mean Lower Low Water	0.0 feet
Extreme Low Water	-4.5 feet

Enclosure (1)
Attachment (6)

Everett Tide Access
SO Foot Depth Requirement



Enclosure (1)
Attachment (7)

CVN 68 Class Water Depth Requirements for Bremerton

	Pier	Turning Basin	Inner Channel	Outer Channel
Draft	40.8	40.8	40.8	(f)
Trim	0.8	0.8	0.8	
List	1.4	1.4	-	
Appendages	-	-	-	
Salinity & Temp (a)	0.5	0.5	0.5	
Motions (b)	-	-	-	
Squat (c)	-	-	1.0	
Heel (d)	-	-	0.8	
Clearance (e)	6.0	6.0	6.0	
TOTAL	49.5	49.5	49.9	

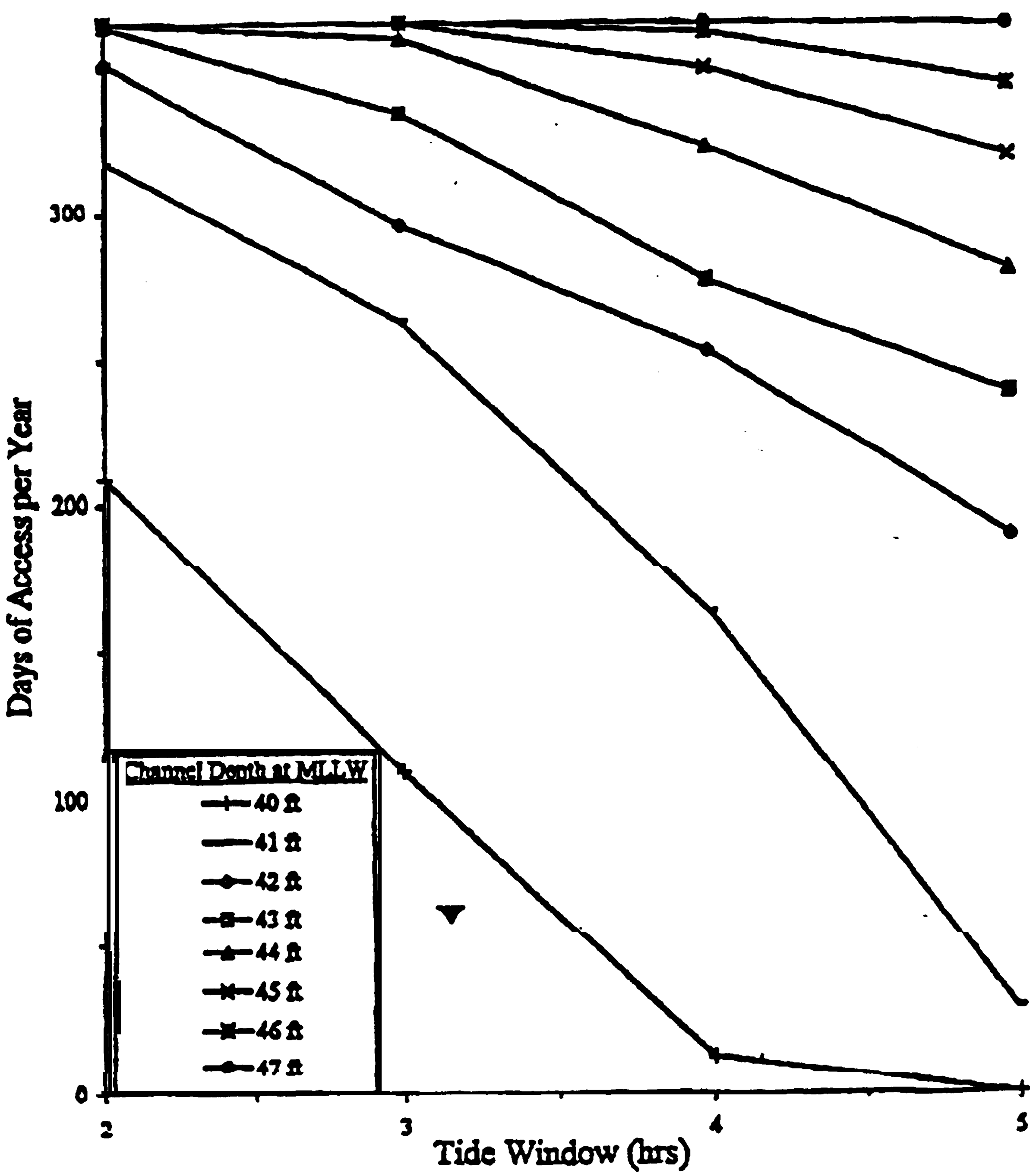
Notes: (a) Harbor contains fresh water inlet.
(b) Protected harbor; no significant wave action.
(c) Based on wide, 50 ft deep channel; need more information.
(d) Operational experience.
(e) Standard clearances.
(f) Unrestricted outer channel due to deep depth.

Bremerton Tide Data

Mean Higher High Water	11.7 feet
Mean Lower Low Water	0.0 feet
Extreme Low Water	-4.7 feet

Enclosure (1)
Attachment (8)

Rich Passage Tide Access
50 Faot Depth Requirement



Enclosure (1)
Attachment (9)

CVN 68 CLASS SHIPYARD WATER DEPTH REQUIREMENTS

Attachments:
(1) CVN 68 Class Shipyard Draft and Clearance Requirements
(2) CVN 68 Class Water Depth Requirements for Norfolk Naval Shipyard
(3) Elizabeth River Tide Access, 47 foot Depth Requirement
(4) CVN 68 Class Water Depth Requirements for Newport News Shipbuilding
(5) Sewell's Point Tide Access, 47 foot Depth Requirement
(6) CVN 68 Class Water Depth Requirements for Puget Sound Naval Shipyard
(7) Rich Passage Tide Access, 47 foot Depth Requirement
(8) CVN 68 Class Water Depth Requirements for Pearl Harbor Naval Shipyard
(9) Pearl Harbor Inner Channel Tide Access, 47 foot Depth Requirement
(10) CVN 68 Class Water Depth Requirements for Long Beach Naval Shipyard
(11) Terminal Island Tide Access, 47 foot Depth Requirement

Enclosure (2)

CVN 68 Class Shipyard Draft and Cl-cc Requirements

Static Draft				
Mean	37.9 ft = 94,800 tons (CVN 68-75) = 95,200 tons (CVN 76)			- Accounts for: Actual operating condition (+2000 tons) Service life weight growth (+70 tons/year) Unreported weight Variable loads at 55% full load capacity. - Assumes weight is added in best location. - Assumes good ship weight control.
Trim	0.25 degrees	Bow	2.3 ft	- Based on operational experience. Instances of greater trim do occur, but rarely when the ship is at or near the limiting displacement.
		Sea Chest	0.8 ft	
		Rudder	2.1 ft	
List	Pier	2 degrees	Bilge Keel 2.3 ft	- Based on operational experience. Instances of greater list do occur, but rarely when the ship is at the limiting displacement.
			Sea Chest 1.4 ft	
	Channel	0 degrees		- Assumed ship is leveled prior to transit. ~~TYCOM confirmation is needed.~~
Appendages	9 inches			- All of the CVN 68 Class except CVN 70 have discharge sea chest diffusers. - Assumed to be overshadowed by trim.
Salinity & Temperature	0.5 feet (50% salinity reduction & 10° temperature rise)			- This calculation is port, season, and tide specific. - Assumed constant.
Dynamic Draft				
Wind & Waves	Outer Channel		See Note	- This calculation is port specific. - See indiv. port summary sheet for details.
	Inner Channel		0 ft	- Protected harbor.
	Pier & Turning Basin			
Squat	10 kts	Forward	0.9 ft	- Based on wide channel that is 50 ft deep. - Shallower and/or narrower channels and/or higher speeds will require a greater allowance for squat.
		Aft	1.3 ft	
		Sea Chest	1.0 ft	
Heel	1.4 degrees	Bilge Keel	1.6 ft	- Based on operational experience, 10 kts and 10 degrees rudder.
		Sea Chest	0.8 ft	
Clearance				
Fouling	6 ft			- Based on operational experience at NOB and NAVFAC study and applies to soft bottoms and bottoms with loose sea growth. - Assumes diffusers are installed.
Grounding	Soft Bottom		2 ft	- NAVFAC deterministic standard.
	Hard Bottom		3 ft	
	1/100			- Proposed probabilistic standard.

Enclosure (2) Attachment (1)

CVN 68 Class Water Depth Requirements for Puget Sound Naval Shipyard

	Pier	Turning Basin	Inner Channel	Outer Channel
Draft	373	379	379	(f)
Trim	0.8	0.8	0.8	
List	1.4	1.4	-	
Appendages	-	-	-	
Salinity & Temp (a)	0.5	0.5	0.5	
Motions (b)	-	-	-	
Squat (c)	-	-	1.0	
Heel (d)	-	-	0.8	
Clearance (e)	6.0	6.0	6.0	
TOTAL	46.6	46.6	47.0	

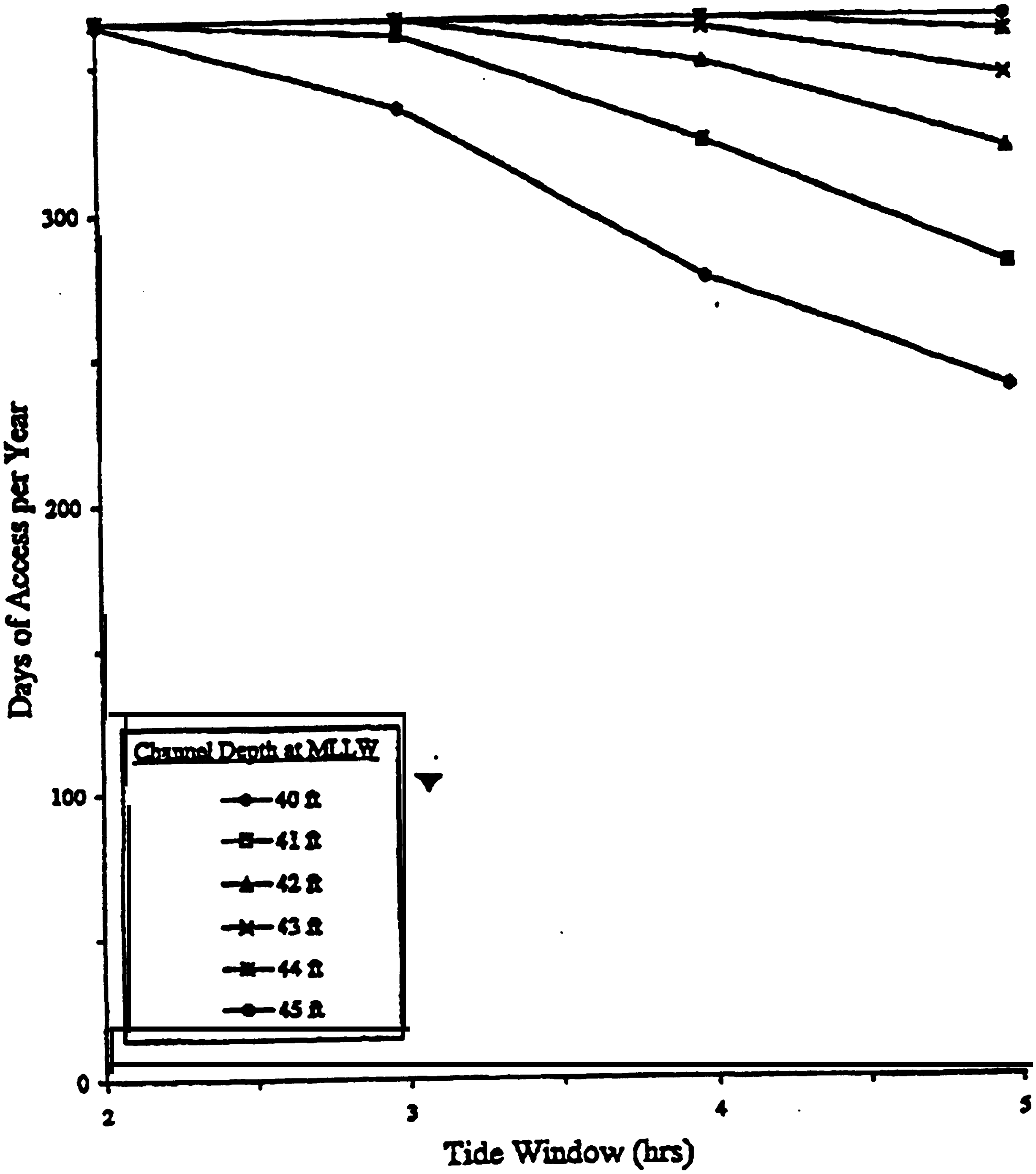
Notes:
(a) Harbor contains fresh water inlet.
(b) Protected harbor; no significant wave action.
(c) Based on wide, 50 ft deep channel; need more information.
(d) Operational experience.
(e) Standard clearances.
(f) Unrestricted outer channel due to deep depth.

Bremerton Tide Data

Mean Higher High Water	11.7 feet
Mean Lower Low Water	0.0 feet
Extreme Low Water	-4.7 feet

Enclosure (2)
Attachment (6)

Rich Passage Tide Access
47 Foot Depth Requirement



Enclosure (2)
Attachment (7)

CVN 6% Class Water Depth Requirements far Pearl Harbor Naval Shipyard

	Pier	Turning Basin	Inner Channel	Outer Channel
Draft	37.9	37.9	37.9	37.9
Trim	0.8	0.8	0.8	2.1
List	1.4	1.4	-	-
Appendages	-	-	-	-
Salinity & Temp (a)	-	-	-	-
Motions (b)	-	-	-	(f)
Squat (c)	-	-	1.0	1.3
Heel (d)	-	-	0.8	-
Clearance (e)	6.0	6.0	6.0	2.0
TOTAL	46.1	46.1	46.5	(f)

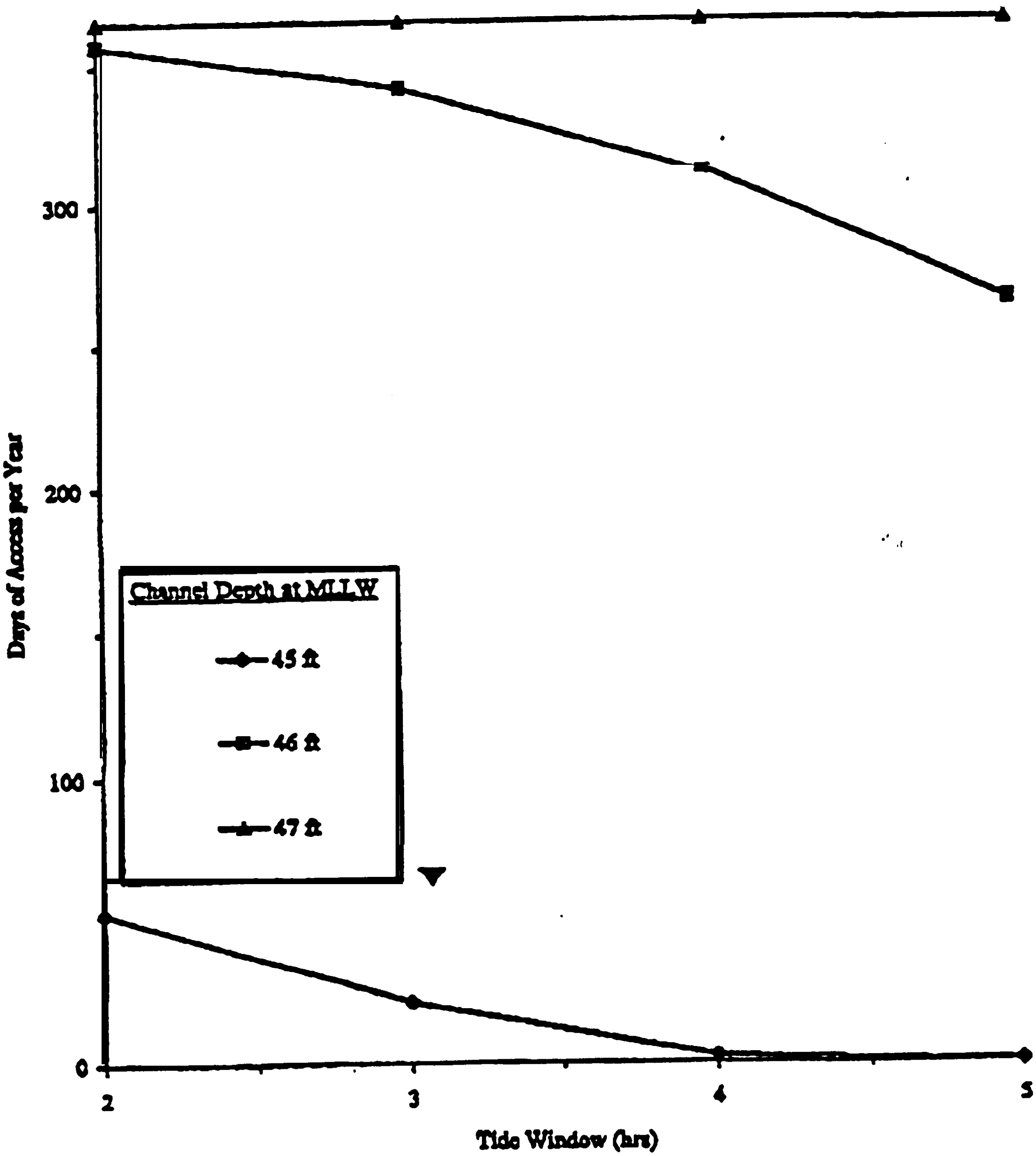
Notes:
(a) Salt water port; no correction required
(b) Unprotected harbor; significant wave action.
(c) Based on wide, 50 ft deep channel; need more information.
(d) Operational experience.
(e) Standard clearances.
(f) Analysis not complete.

Pearl Harbor Tide Data

Mean Higher High Water	2.0 feet
Mean Lower Low Water	0.0 feet
Extreme Low Water	-1.6 feet

Enclosure (2)
Attachment (8)

Pearl Harbor Inner Channel Tide Access
47 Foot Depth Requirement



Enclosure (Z)
Attachment (P)

CVN 68 CLASS SHALLOW WATER NAVIGATION IMPROVEMENTS

Due to the deep draft of the CVN 68 Class aircraft carriers, port and shipyard access can be restricted. In order to minimize the cost and environmental impacts of deep dredging, actual ship loading, tides, and favorable weather conditions can be used. Utilizing these factors affects operational issues such as operating schedule and contingencies as well as ship loading and speed. Actual transit situations will vary and will involve different combinations of these factors. Current dredging plans will not provide unrestricted access to CVN 68 Class home ports and shipyards. To reduce the risk of grounding, it is recommended that shallow water navigation aids be improved.

The wave and motion determination process in shallow water is complex. Wave conditions are port dependant; each port must be individually studied for an accurate assessment. The most extreme CVN motions are generated from sea swells originating from storms hundreds of miles away; consequently, they are difficult to detect. Waves and swells are predicted from the Fleet Numerical Oceanographic Center or observed by the crew. Waves seen in or predicted for the open ocean may not be that which are experienced at any given port. Local land and bottom effects and changes due to wind, tides, and currents are not included.

This plan improves onboard shallow water navigation aids by:

(a) Providing a channel guidance system.
(b) Providing real time channel condition measurement.
(c) Improving ship's draft and attitude indication.
(d) Providing a load management system.

These systems and other supporting systems would be integrated as appropriate to facilitate overall functionality and minimize cost.

Channel Guidance System

NAVSEA has developed and tested an onboard CV Channel Guidance System (CVCGS). This system aids in the determination of under keel clearances and the probability of grounding while operating in ports. It is a PC computer program which calculates depth requirements based on data from the ship's force concerning load and trim conditions. Environmental conditions are down loaded from Fleet Numerical or input from the ship's navigator. Ship motions, under keel clearance, and probability of grounding predictions are then calculated for channel transits. The CVCGS has been validated by ship model tests and full scale wave measurements. This system will be sent to all CVs by the end of FY95.

Channel Condition Measurement

The Environmental Monitoring and Operator Guidance System (EMOGS) incorporates analysis capabilities of the CVCGS. However, instead of using predicted information from Fleet Numerical and the navigator, EMOGS uses real time wave and tide data from sensors installed in the channel. Because this is a far more accurate prediction of waves and variable water levels, substantial risk reductions are realized. The following table shows the accessibility levels of CVCGS and EMOGS associated with different dredge depths for San Diego and Mayport. An EMOGS type system is successfully being used by SUBLANT at Kings Bay, Georgia for SSBN 726 Class transits. EMOGS is recommended for channels not dredged for unrestricted operations and are subject to wave action, particularly swells. EMOGS is a facilities improvement cost tradeoff with dredging.

OUTER CHANNEL ACCESSIBILITY
FOR A RISK OF EXCEEDING DREDGE DEPTH 1 IN 100 TIMES

CHANNEL DEPTH (feet)	DAYS PER YEAR	
	CVCGS	EMOGS
SAN DIEGO:		
55	227	333
59	295	355
MAYPORT:		
47	254	262
50	362	363

Without guidance of any sort in avoiding extreme wave conditions, risk may increase to 1 in 2.

Draft and Attitude Indication

Currently, the CVN 68 Class only has one Remote Draft Indicator and list and trim inclinometers. The Profile Draft Indicator has been removed because it contained about a pint of mercury. Consequently, the ship does not have the ability to accurately determine the ship's daft, list, and trim. Installation of two more Remote Draft Indicators would provide the ability to triangulate accurate draft, list, and trim values. Based on simple geometry, the ship could then accurately determine the extreme draft point. A JCF and ECPs are being prepared to add two Remote Draft Indicators.

Load Management System

The CVN 68 Class carries roughly 20,000 tons of loads (aircraft, fuel, personnel, stores, etc.). There are some 415 tanks and voids and some 245 storerooms and magazines. The amount of material continuously being brought onboard, moved, and being consumed is large. Aircraft carrier operations require the flight deck to be as level as possible. There is a list control system to account for aircraft movement. A system similar to those used on tankers (commercial and AOEs) would provide the ship with a tool to better track and manage loads. This would enable the crew to minimize displacement, list, and trim; thereby, minimize operational restrictions. A load management system is being investigated by the CVN 76 IC effort.

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IN REPLY REFER TO
11460
Ser PMS312M12/998

08 NOV 96

Program Executive Office, Carriers, Littoral Warfare and Auxiliary ships (PMS 312)
Commander, Puget Sound Naval Shipyard (Code 100)

: **AIRCRAFT CARRIER CVN 68 CLASS WATER DEPTH REQUIREMENTS FOR PUGET SOUND NAVAL SHIPYARD**

Raf: (a) PSNS ltr 11010 Ser 3910N/7005 of Nov 7, 1996
(b) NAVSEA ltr 11460 Ser 03D3/242 of 3 Jan 95

1. Reference (a) requests a waiver of the water depth requirement of 0.5 feet that accounts for salinity and temperature factors for Puget Sound Naval Shipyard located on Sinclair Inlet as depicted in attachment (8) of enclosure (1) of reference (b) and attachment (6) of enclosure (2) of reference (b). This request is based on the fact that this requirement does not apply to Sinclair Inlet since it has no major fresh water inlets and salinity readings taken show the specific gravity of the inlet as I.023 compared to 1.025 in the ocean and 1.000 for fresh water.

2. PEO CLA concurs in the reference (a) and approves the requested waiver. The following changes to attachment (8) of enclosure (1) of reference (b) are authorized as follows; delete the OS feet added to the 'Salinity & Temperature (a)" across the chart. Additionally, change Note (a) to read - 'Sinclair Inlet has no major fresh water inlets.' The total depth requirements should be amended to:
a. Pier: 49.0 feet
b. Turning Basin: 49.0 feet
c. Inner Channel: 49.4 feet

3. PEO CLA also authorizes the following changes to attachment (6) of enclosure (2) of reference (b); delete the 0.5 feet added to the "Salinity & Temperature (a)" across the chart. Additionally, change Note (a) to read - "Sinclair Inlet has no major fresh water inlets.' - The total depth requirements should be amended to:
a. Pier: 46.1 feet
b. Turning Basin: 46.1 feet
c. Inner Channel: 46.5 feet

4. These changes will be subsequently issued to all holders of reference (b) as an errata sheet.

APPENDIX I

MAINTENANCE IN HOME PORT

APPENDIX I
MAINTENANCE IN HOME PORT

Homeporting of a NIMITZ-class aircraft carrier would involve repair and maintenance ship's systems and their components. Repair and maintenance work would mostly be done onboard ship. Work done on the propulsion plant would involve both primary and secondary propulsion plant systems. Primary plant propulsion systems contain radioactive materials in the form of activated corrosion and wear products. Pier-side maintenance facilities, such as a Depot Maintenance Facility, would support any shipboard work as well as work on components removed from the ship.

Typical of the work done on ship's piping and associated components are: removal of thermal insulation to gain access to propulsion plant systems, cutting grinding, machining, welding paint chipping and scraping, sand or grit blasting, solvent wipe downs, painting, valve packing, and seal and gasket replacement. Non-destructive test (NDT) methods for inspecting propulsion plant systems and component integrity would include such testing as dye penetrant, radiography, ultrasonic, magnetic particle, and eddy current. Resin and filter media would be removed and replaced. Refueling/defueling of nuclear reactors on NIMITZ-class aircraft carriers can only be done at a qualified shipyard during a defueling/refueling availability. No refueling/defueling availabilities are planned for any of the alternative sites qualified to perform refueling/defueling although PSNS has the facilities to be able to accomplish this work. Electrical work would include repair, removal, or replacement of various electrical panels, cabinets, wiring and cables.

Temporary systems, which supply air, water, electricity, etc., are needed to support ship's maintenance. Tanks would be located adjacent to the ship to receive various fluids discharged for processing (e.g., radioactive liquid drained from the nuclear propulsion plant, oily waste water from bilges, and effluent from ship's sanitary tanks). Temporary ventilation systems with High Efficiency Air Particulate (HEPA) filters and Air Particulate Samplers (APS) would be installed to reduce air emissions from work Radioactive liquid collection tanks are constructed with heavy gauge corrosion resistant steel, and are very robust. These tanks are connected to the ship by temporary hoses that are tested and certified before use, and are radiologically controlled and operated by the strict control procedures discussed in Chapter 7 of this EIS. The tanks are then transferred to the Controlled Industrial Facility for processing.

Whenever a primary propulsion plant system would be opened, stringent radiological controls would be employed including the use of contamination containments and when necessary, localized ventilation equipment with HEPA filters to prevent the spread of contamination. For details concerning the origin and characteristics of the radioactivity and the radiological controls used, see Chapter 7. Low-level radioactive waste generated during maintenance work would include items such as resin and filter media, used HEPA filters, components no longer fit for use, decontamination rags on non-reusable anti-contamination clothing. Stringent controls would be employed to prevent generation of mixed radioactive and chemically hazardous waste.

Work involving hazardous materials would be accomplished in appropriately controlled areas by personnel wearing the required protective equipment. All these materials would be controlled per applicable requirements thus assuring the Navy, regulatory agencies, and public that handling and disposal of hazardous materials would not pose a risk to human health or the environment.

The Navy has instituted programs to reduce or eliminate the use of hazardous materials in its design of recent ships, such as NIMITZ-class aircraft carriers. Navy use of PCBs and asbestos has been reduced or eliminated wherever practicable. A potential still exists for small amounts of PCBs to be found in cables and sealed electrical components (such as transformers and capacitors) and, although the use of friable asbestos has been eliminated from thermal insulation, asbestos is still used in some valve packing, seals, and gaskets. Another hazardous material, lead, is used to shield maintenance personnel from radiation and would be used as needed during repair work.

DEPOT-LEVEL MAINTENANCE

Aircraft carrier maintenance is categorized into three levels: organizational, intermediate, and, depot levels. Organizational level (routine) maintenance can be done by the ship's crew using equipment and systems on board the vessel. Intermediate level maintenance is more complex, requiring an Intermediate Maintenance Activity (IMA) with more complete repair capabilities than that found aboard the ship. Depot-level maintenance is performed when major repairs or a complete rebuild of all or portions of a CVN propulsion plant system component is needed. This maintenance is accomplished at the public or private shipyard and by civilian Master Ship Repair contractors, and requires extensive, local industrial capabilities. A Depot Maintenance Facility (DMF), or equivalent, is necessary for performing depot-level maintenance while a CVN is homeported. A DMF consists of the following:

- A Controlled Industrial Facility (CIF) used for the inspection, modification, and repair of radiologically controlled equipment and components associated with Naval nuclear propulsion plants. It also provides facilities and equipment for the treatment, reclamation, and packaging for disposal of radiologically controlled liquids and solids. It includes non-radiologically controlled spaces for administrative and other support functions. (See detailed CIF description below.)

- A Ship Maintenance Facility (SMF) housing the machine tools, industrial processes, and work functions necessary to perform non-radiological depot-level maintenance on CVN propulsion plants. (See detailed SMF description below.)

- A Maintenance Support Facility (MSF) housing both administrative and technical staff offices supporting CVN propulsion plant maintenance, as well as a central area for receiving, inspecting, shipping, and storing maintenance materials. (See detailed MSF description below.)

Detailed CIF Description

A newly designed CIF, similar to facilities existing at PSNS and NASNI, would have both radiological and non-radiological areas. The radiological controlled area would be approximately 34,900 square feet and would be used for industrial work requiring radiological control. It would house both high and low bays. The high bay would be serviced by a high capacity (approximately 60 ton) bridge crane and the low bay would be serviced by a smaller capacity (approximately 25 ton) crane. Personnel entry and exit to the radiological work area would be controlled through a single point located in the adjacent non-radiologically controlled area. The non-radiologically controlled area would be approximately 13,100 square feet covering two stories and would house an administrative support area. Total area of a CIF is approximately 48,000 square feet.

The design of a CIF follows conservative methods widely accepted by the engineering community and provides for additional "factors of safety" in redundant structural design features. The radiologically controlled area of a CIF would include proven design features established by Navy requirements to minimize potential risk to the environment, the general public, and workers. For example:

- ***Walls and Floors.*** The CIF would be a tightly constructed concrete and steel structure on a supported (usually by stone columns) slab. The walls of the building would be designed to reduce radiation levels at the exterior of the building to levels that do not require monitoring personnel for radiation exposure. Stringent design criteria would be chosen for the foundation of the CIF. These procedures would result in a system that will reduce the effects of liquefaction and ensure a solid and competent foundation under all credible seismic loading conditions. Surfaces that could potentially become contaminated, such as the containment interiors and the building floors, would have impermeable, easily cleaned surfaces such as stainless steel with polyurethane or epoxy coating. Where there is a potential for liquid spills, curbs or basins would be used that would collect and retain the largest credible quantity of liquid that could be encountered. All entrances to the building would be sloped or sealed to retain liquids. There would be no piping connections that could discharge contaminated or potentially contaminated effluents outside the controlled area. The floor would not be penetrated by pipes, conduits, or drams.

- ***Ventilation and Containment.*** All doors into the radiologically controlled work area would have gasket seals. There would typically be two or more barriers separating the environment from radiological work. This would be accomplished by using containment enclosures to do work inside of the radiologically controlled work area. Ventilation would maintain air pressure within the containment enclosure slightly less than in the radiological work area, which would be maintained at a pressure slightly less than outside air pressure. This ensures that all air movement is inward, rather than out of the building. Within the containment enclosures, localized ventilation would be employed where necessary to pull air away from the work directly into High Efficiency Particulate Air (HEPA) exhaust filters, which then would exhaust into the controlled area. All air exhausted from the controlled area would pass through the building ventilation system's HEPA filters. This provides two stages of HEPA filtration and limits the potential for contaminating ventilation ductwork in the building. All HEPA filters would be tested when installed and at least annually thereafter using standard test methods to verify they are at least 99.95% efficient at removing submicron particles. A continuously operating air particulate sampler installed in the building's exhaust to the atmosphere would monitor for radioactivity downstream of the filters to ensure compliance with air quality requirements established by the EPA under 40 CFR 61, subpart I.

Work activities within a CIF would include mechanical &assembly/reassembly, decontamination, machining, liquid processing, inspection, welding, cutting, waste processing and storage, and shipping. Generally, a CIF would handle only small quantities of low-level radioactivity, predominately cobalt 60. Cobalt 60 is the primary radionuclide of interest for Naval nuclear propulsion plants. The source of this radioactivity is the result of small amounts of activated corrosion products from ship's valves, piping, and other reactor plant components that will be inspected, repaired, or prepared for disposal, and in the liquid that would be processed for reuse. Section 7 contains a more detailed description of the radioactive materials and the stringent controls employed in the Naval Nuclear Propulsion Program to protect personnel and the environment. In general, the radiologically controlled portion of the CIF would support all aspects of maintenance and repair of ship's components that have become radioactive. Specific work sites in the controlled area would include the following:

- a small component repair area with isolation enclosures for disassembly, inspection, and repair of small workbench-sized items.
- a large component repair area with larger enclosures for work on items like portable tanks, demineralizers, filter housings, and large propulsion plant components.
- a small component machining center with a variety of machine tools set up in isolated work enclosures.
- an area for material storage.
- a tank receiving area and liquid processing facilities.
- a hose maintenance area.
- a liquid solidification area.
- a solid radiological waste processing complex.
- a radiochemistry laboratory.
- a segregated radioactive waste storage area.

Detailed SMF Description

An SMF would contain the machine tools, industrial processes, and work functions necessary to perform non-radiological depot-level maintenance on NIMITZ-class propulsion plants. An SMF would allow onsite accomplishment of nearly all of the specialized propulsion plant work required during a 6-month depot-level maintenance period, with some exceptions such as large diameter pipe bending, heavy machining, metal forging, motor rewinding, and large valve/pump testing depending upon the specific alternative site.

An SMF would be approximately 114,000 square feet of steel and concrete construction. It would be serviced by medium capacity jib and bridge cranes ranging up to approximately 25-ton capacity. It would have three primary bays containing the major shop work areas. An partial second floor on one side of the building would house supervisory office space and a gage calibration lab. The first floor area underneath would contain work areas, tool rooms, shop stores, locker rooms, showers, and restroom facilities. An SMF would have a concrete floor with special foundation areas for major equipment.

The following paragraphs describe some of the typical work functions that would be performed in the building:

- *Shipfitter Shop:* The shipfitter shop would fabricate and modify steel structures including equipment foundations and pipe hangers. This shop would also perform structural work on tanks. Work processes would include metal layout, flame cutting, bending, grinding, and structural fitup.

- ***Sheetmetal Shop:*** ***The*** sheetmetal shop would fabricate and modify sheetmetal items such as cabinets and ventilation system components. Work processes would include sheetmetal layout, cleaning, cutting, bending, fitup, and spot welding.
- ***Pipefitter Shop:*** The pipefitter shop would fabricate, modify, clean, and test piping system components and assemblies. Work processes would include pipe and component cleaning, pipe bending, machining preparations, and fitup. This shop would also fabricate pipe bending templates for pipe too large to be handled in the facility and that would need to be bent elsewhere.
- ***Weld Shop:*** ***The*** weld shop would be capable of performing the wide range of high quality welding and other thermal joining processes associated with propulsion plant components. These would include structural welding, sheet metal welding, and pipe welding and brazing. Local exhaust ventilation would be provided.
- ***Machine Shop:*** The machine shop would disassemble, refurbish, reassemble, and test mechanical assemblies including valves, pumps, and hydraulic system components. It would have the capability of manufacturing new parts for these assemblies. Work processes would include mechanical assembly/disassembly, machining, grinding, and hydrodynamic pump/valve test stand operations.
- ***Electrical Shop:*** The electrical shop would repair and test cables, motor controllers, breakers, and other electrical system components.
- ***Electronics Shop:*** ***The*** electronics shop would repair, modify, and test electronic system components and assemblies. Facilities would be provided for calibrating pressure and temperature gages and other instruments. Some of this work would be accomplished in a clean, temperature-controlled environment.
- Insulator Shop: The insulator shop would remove and install insulation covering used on propulsion plant piping systems and propulsion plant components. It would have the capability to remove asbestos and fiberglass insulation. It would have HEPA-filtered exhaust ventilation and asbestos worker shower facilities.
- ***Paint Shop:*** The paint shop would clean and paint components and assemblies. Processes would include scraping, grinding, chemical cleaning, abrasive blasting, and painting. The shop would be equipped with modem abrasive blast booths and paint booths employing the appropriate emissions-control technology.
- ***Tool Shop and Tool Rooms:*** The tool shop would manufacture, repair, and calibrate machine tools including electric and pneumatic powered tools. It would have precision machining and grinding equipment, and heat treating capability. It would have calibration equipment for torque wrenches and other calibrated tools. Some of this work would be performed in a clean, temperature- and humidity-controlled area. The tool room would store and issue common industrial tools and safety equipment needed by the workforce.
- ***Woodworking Shop:*** The woodworking shop would fabricate and repair glass reinforced plastic (GRP) components. It would cut Formica coverings. The shop would manufacture

a variety of wood products to support ship maintenance including temporary covers, platforms, cofferdams, and shipping boxes for transporting equipment. It would have a variety of saws, drill presses, planers, and other woodworking equipment, as well as the tools associated with GRP work. A distributed exhaust ventilation system would collect sawdust and transport it to a baghouse. A HEPA ventilation system would be used for GRP work.

- ***Fabric Workers Shop:*** The fabric workers shop would fabricate temporary waterproof containments, tarpaulins, covers, and other fabric items supporting reactor plant maintenance.
- ***Rigger Shop: The*** rigger shop would store and maintain rigging gear such as chainfalls, shackles, wire rope pendants, etc. that are used in equipment lifting and handling operations.
- ***Temporary Services Shop: The*** temporary services shop would maintain, test, and install mechanical and electrical equipment used shipboard to provide temporary ventilation, lighting, compressed air, and other support services required during propulsion plant overhaul.
- ***Shipping, Receiving, and Laydown:*** Areas would be provided within the facility for material receiving and shipping, as well as space for temporary laydown of materials being processed into and out of the work areas.
- ***Pure Water Production:*** The pure water facility would have a plant that employs treatment, filtration, and demineralization processes to produce and store the relatively large quantities of pure water required for reactor plant maintenance, including cleaning and flushing of plant components.
- ***NDT Laboratoy:*** A non-destructive-testing (NDT) laboratory would be equipped to provide the wide range of quality assurance processes used to inspect propulsion plant components. These include x-ray, liquid penetrant, ultrasonic, magnetic particle, and optical comparator inspections.
- ***Chemistry Laboratory:*** A chemistry laboratory would provide chemical analysis of water and other materials associated with propulsion plant maintenance.

Detailed MSF Description

A MSF would include a two-story, 82,000-square-foot concrete and steel building that would house the primary administrative and technical staff offices supporting NIMITZ-class propulsion plant maintenance, as well as the central area for receiving, inspecting, shipping, and storing materials. This facility would also provide a marshaling point for personnel beginning and ending shift work aboard the ships, and would contain locker, restroom, and shower facilities. In addition, the building would include an area for manufacturing, testing, and storing rigging gear, areas for personnel training and briefings, a teleconference facility, an area for training on equipment mockups, an area for document reproduction and **storage, a mail room,** and **a radiation** health office for supplying dosimetry equipment. An area would be provided for accumulation (less than 90 days) of chemically hazardous waste generated from propulsion plant maintenance activities. This waste would be handled in accordance with applicable federal, state, and local regulations. This waste would be picked up by the Navy for storage and transportation to permitted disposal facilities or to an industrial waste processing facility.

A MSF would also have a 7,200-square-foot Tank Storage Facility for portable radioactive liquid waste collection tanks, and a 2,270-square-foot Mixed Waste Storage Facility. These proposed facilities would be concrete and steel or cinder block construction with concrete floors and foundations.

The Tank Storage Facility would provide secure storage for tanks used to collect radiologically controlled liquid from ships. The tanks would normally be empty, containing only residual liquid; however, full tanks could occasionally be temporarily stored waiting for transport to a CIF for liquid processing.

The Mixed Waste Storage Facility would be a small building dedicated to storage of Naval Nuclear Propulsion Program waste that is a mixture of low-level radioactive waste and chemically hazardous waste. Detailed characterization of Naval Nuclear Propulsion Program mixed waste has been accomplished using sampling and extensive process knowledge, and has confirmed that the waste is suitable for safe storage until it is shipped offsite for treatment and disposal. Mixed waste stored in this facility would be primarily solid in form and stored in sealed containers. The mixed waste storage facility would be operated in accordance with applicable regulations for hazardous waste.

Both the Tank Storage Facility and the Mixed Waste Storage Facility would utilize special design features to minimize risk to the environment, the general public, and workers. These include a concrete floor and containment curbs with impermeable surface coatings. The floors would not be penetrated by pipes, conduits, or drains. The concrete walls would be designed to reduce radiation levels at the exterior of the building to levels that do not require monitoring personnel for radiation exposure. See Section 7 for a detailed discussion of these facilities.

A MSF would also have fencing and other security measures at the maintenance facility and two fenced 5,000-square-foot equipment staging/laydown areas near the CVN berth area). The staging/laydown areas would be paved, and a building would occupy approximately half of each staging area.

All alternative sites were evaluated to DMF standards. The final analysis concluded that two sites, NASNI and PSNS have all of the capabilities listed above. Everett does not have these facilities. Pearl Harbor has all of the assets of a DMF except for (1) a CIF with enough floor space and crane capacity, (2) pure water production capacity would need to be increased, and (3) a higher capacity pump/valve test facility would need to be constructed.

1

APPENDIX J

ANALYSIS OF A HYPOTHETICAL AIRBORNE RELEASE OF HAZARDOUS SUBSTANCES WITH RESPECT TO CVN HOMEPORTING

ANALYSIS OF A HYPOTHETICAL AIRBORNE RELEASE OF HAZARDOUS SUBSTANCES WITH RESPECT TO CVN HOMEPORTING

PREPARED BY:

PUGET SOUND NAVAL SHIPYARD

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1 PURPOSE OF ANALYSIS

1.1 This analysis estimates the impact resulting from a hypothetical accident involving the release of hazardous substances at each of the homeport locations for nuclear-powered aircraft carriers (CVNs) identified in the Environmental Impact Statement (EIS). Homeport locations being addressed in this EIS are: Naval Air Station, North Island (NASNI); Puget Sound Naval Shipyard (PSNS); Naval Station (NAVSTA) Everett; and Pearl Harbor Naval Shipyard (PHNSY).

1.2 Maintaining naval ships requires the use of hazardous substances. Organizations that use hazardous substances are subject to federal, state, and local regulations. The intent of these regulations is to ensure worker, general public, and environmental protection during the use and disposal of hazardous substances. Naval activities comply with these regulations by managing hazardous substances in accordance with Navy procedures. Even with these regulations and procedures, use of hazardous substances could result in an accident involving their release. There are several potential scenarios, including a fire and a spill, which could result in hazardous substances being released. This analysis conservatively estimates the potential for impact to human health as a result of a hypothetical airborne accidental release scenario with no mitigating measures. This analysis will be used to determine whether CVN maintenance activities at the homeport locations would result in an adverse impact from an accidental release of hazardous substances. A spill into navigable waters is not analyzed under 40 CFR 1502.22 of the Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) because of scientific uncertainty. There is currently no accepted method that comprehensively measures the impacts of such a spill of hazardous substances on human health and the environment (see section 4.4.2 of this Appendix).

1.3 The method used by this analysis is based on Federal Regulation 40 CFR 68 and California Code of Regulations (CCR) Title 19. The states of Hawaii and Washington have no supplemental regulations on analysis of airborne release. Enclosure A discusses the background of these regulations implemented by the U. S. Environmental Protection Agency (EPA) and the California Office of Emergency Services.

1.4 Hazardous substances released during normal use (e.g., evaporation of volatile constituents in paint) are addressed in Volume I, Chapters 3 through 6 of the EIS under the “Operations” section in the various resource areas (i.e., Water Quality, Air Quality, Health and Safety, etc.) The present analysis is only applicable to an accidental release of hazardous substances.

2 FACTORS THAT DEFINE THE EXTENT OF THIS ANALYSIS

2.1 Planned Incremental Availabilities (PIAs)

As discussed in Volume II, Appendix G of this EIS, depot-level maintenance is accomplished on CVNs six months out of every two years. These depot-level maintenance periods are called Planned Incremental Availabilities (PIAs). Volume II, Appendix I of this EIS describes the type of work accomplished during a CVN PIA and the permanent maintenance facilities required to support this work. In addition to the permanent facilities, portable facilities called "flammable material storage lockers" are used for staging hazardous substances used during a CVN PIA. The storage lockers are located on the piers next to the CVNs.

2.2 Hazardous Substances Used During CVN Maintenance

The "source term" is defined as the quantity of hazardous substances available for release during a hypothetical accidental release scenario. The source term for this analysis is based on historical data for hazardous materials used by PSNS over a six-month period during a recent (1997) PIA on the USS CARL VINSON (see Enclosure B of this appendix). Since a PIA represents the largest quantities of hazardous substances handled during the operational cycle of a CVN, use of these data conservatively estimates the impacts from hazardous substance management from homeporting a CVN.

While the USS CARL VINSON data consist of the hazardous substances actually used during this specific PIA, this data is representative of other CVN PIAs. Although there may be some small variation in hazardous substances depending on the type of work accomplished and the types of products available, there would not be a significant difference between hazardous materials used for the USS CARL VINSON PIA and a PIA conducted at a different location. Thus, the source term used in this analysis is an accurate representation of the hazardous materials used during a CVN PIA at each homeport location.

Hazardous substances used during a PIA are staged in different locations by the various organizations performing maintenance. These organizations include contractors, the ship's crew, and shipyard personnel. These organizations typically use a total of two or three hazardous material storage lockers during a PIA. The storage lockers are constructed of heavy-gauge steel, are non-combustible, and have individual fire suppression systems. Thus, even if a fire in one locker is postulated, it is not likely that the fire would create a fire in an adjacent locker, and therefore only one locker is assumed to be involved in the accident at a time.

2.3 Material Handling

This analysis uses assumptions that are conservative, such as not considering existing mitigating management practices currently in place to safely manage hazardous substances, which ensures the actual consequences of any conceivable accidental release would be less than those estimated in this analysis. For example, flammable material storage lockers are specially designed for storing hazardous substances, and the Navy minimizes the contents of these lockers by using staggered delivery schedules to mirror only ongoing work. For conservatism, this analysis ignores all of these special handling requirements when estimating consequences of a hypothetical accidental release. Enclosure C describes one example of the Navy's procedures for ensuring the safe management and control of hazardous substances.

2.4 Application of this Analysis to Homeport Locations

This analysis assumes that CVN homeporting activities are new functions at each homeport location considered. However, many homeport locations already support homeported aircraft carriers and other types of propulsion plant maintenance and are discussed in Volume 1, Section 2 of the EIS. Application of this analysis to the homeport locations is discussed further in Volume I, Sections 3.15, 4.15, 5.15, and 6.15.

In the case of NASNI, where it is possible to replace CVs with CVNs, it is important to note that except for radiological aspects, there are no significant differences between the hazardous substances used for conventionally-powered aircraft carrier (CV) or CVN maintenance. Radiological aspects are addressed in Volume I, Chapter 7 of this EIS.

3 HAZARDOUS SUBSTANCE ACCIDENTAL RELEASE ANALYSIS

3.1 Background

40 CFR 68 and CCR Title 19 require analysis of the worst-case accidental release scenarios for both toxic and flammable regulated substances. These regulations specify the parameters for estimating the consequences, but do not prescribe the analytic methods. This analysis uses the methods suggested by references 8.1 and 8.2.

3.2 Substances Selected for Analysis

The hazardous substances used during the USS CARL VINSON PIA comprise approximately 170 industrial products (e.g., paint, insulation, adhesives, and cleaners) containing approximately 270 substances identified by manufacturers' material safety data sheets (MSDS). This list of substances was screened using existing EPA regulations as a basis to identify the hazardous substances posing the greatest risk to human health if released. The screening criteria are identified below and the results of applying the screening criteria to the source term data are illustrated in Tables 1 and 2. After application of the screening criteria, eight toxic and four flammable substances were identified as requiring further analysis.

Screening Criteria:

a) The substance is identified in 40 CFR 68 or CCR Title 19 as a regulated substance, regardless of whether the total weight of the substance in the source term meets the specified threshold quantity required for analysis.

b) The substance exists on EPA's "List of Lists"[1] and is present in a total pure substance weight equal to or above either the threshold planning quantity (TPQ)[2] or reportable quantity (RQ)[3], whichever is less.

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[1] Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act, as Amended (latest version, 1996)

[2] Definition of TPQ - If a facility has a substance present at any one time during a calendar year in excess of the TPQ, the facility is required to report this fact annually in their Tier I or Tier II EPCRA report. The TPQ for each substance is specified in the governing regulation, 40 CFR 370.20(b).

[3] Definition of RQ - Accidental release of a substance at or above the RQ must by law be

c) The total weight of the substance used for the entire PIA exceeds 500 lb.[4]

d) For substances satisfying criteria b) or c) above, the following criteria also apply:

i) Data exist from which to estimate a level of concern (defined in section 4.1.1).

ii) The substance exists in a physical form that is likely to be released to the air in a significant quantity.

iii) The substance is toxic (e.g., water is eliminated from consideration).

Table 1 - Toxic Substances Contained in Products Used During a PIA

40 CFR 68 Toxic	CAS No. [1]	Total Weight (lb.)	40 CFR 68 Regulatory Threshold (lb.)	CCR Title 19 Regulatory Threshold (lb.)
Vinyl Acetate	108-05-4	11.7	15,000	1,000
Formaldehyde	50-00-O	0.2	15,000	500
CCR Title 19 Toxic [2]				
Phenol	108-95-2	0.1	Not Regulated	500
Hydroquinone	123-31-9	0.2	Not Regulated	500
Other Toxics				
Naphtha [3]	64742-95-6	5,200.7	Not Regulated	Not Regulated
N-Butyl Alcohol	7 l-36-3	1,305.7	Not Regulated	Not Regulated
Isopropyl Alcohol	67-63-O	724.7	Not Regulated	Not Regulated
Xylene	1330-20-7	265.4	Not Regulated	Not Regulated

reported to the EPA national response center. The RQ for each substance is specified in the governing regulations, 40 CFR 302, table 302.4 and 40 CFR 355.40, appendices A and B.

[4] 500 pounds was chosen because, per 40 CFR 370, it is the minimum threshold level for reporting extremely hazardous substances, except where there is a lower TPQ value, in which case the lower TPQ value is used for screening. The purpose of 40 CFR 370 is to establish reporting requirements which provide the public with important information on the hazardous chemicals in their communities for the purpose of enhancing community awareness of chemical hazards and facilitating development of state and local emergency response plans.

Table 2 - Flammable Substances Contained in Products Used During a PIA

40 CFR 68 Flammable	CAS No. [1]	Total Weight (lb.)	Total Weight of Product [4] (lb.)	40 CFR 68 Regulatory Threshold (lb.)
Isobutane	75-28-5	1.8	12.0	10,000
Propane [5]	74-98-6	23.1	83.9	10,000
Pentane	109-66-o	57.8	199.5	10,000
Dimethyl Ether	115-10-6	78.5	199.5	10,000

Notes for Tables 1 and 2:

1 - Chemical Abstract Service Number (CAS Number)

2 - Chemicals listed in CCR Title 19 and not listed in 40 CFR 68.

3 - Naphtha is not a pure substance but a mixture of substances whose composition varies significantly depending on manufacturer and intended use. Included in the quantity of naphtha are other similar hydrocarbons, such as mineral spirits and kerosene.

4 - 40 CFR 68.115 .b.2 requires comparing the total weight of the product to the specified threshold quantity, for flammable substances only.

5 - The quantity of propane includes propane and Liquefied Petroleum Gas (LPG). LPG is a mixture of propane and other hydrocarbons with properties similar to propane.

Tables 1 and 2 illustrate that the eight substances in the source term regulated by 40 CFR 68 and CCR Title 19 are significantly below their individual regulatory thresholds. Only xylene (RQ from 40 CFR 302 of 100 pounds) has a total pure substance weight greater than its RQ. The other toxic substances are listed on the basis that they exceed five-hundred pounds. These facts illustrate that all 270 substances in the quantities present that comprise the source term are not considered by EPA and California regulators to pose a significant threat to human health.

3.3 Description of Scenario

The substances described for analysis in Section 3.2 are assumed to be released to the air from a flammable material storage locker as a result of a spill and subsequent fire. No mitigating measures are assumed to be in place at the time of the hypothetical accidental release. The initiating event, although unspecified, might be an airplane crash, ship collision, or severe vehicular accident. Such an event bounds simpler chemical spills involving limited quantities of hazardous substances. Such a flammable material storage locker containing the substances analyzed herein would not require an accidental release analysis per 40 CFR 68 or CCR Title 19.

4 ANALYSIS OF TOXIC SUBSTANCES

4.1 Method of Analysis

The mathematical release rate and dispersion models used for this analysis are specified in references 8.1 and 8.2. These models were chosen for this analysis since they have been used by local emergency planning coordinators throughout the United States over the last 10 years to assess potential concentrations arising from releases of hazardous substances to the atmosphere. The references listed in section 8 were used to support the calculations.

The mathematical models of reference 8.2 can be used to estimate the concentration of a toxic substance in air at any distance between 100 and 10,000 meters from the hypothetical location of a release. In addition, the models can be used to estimate the distance from this hypothetical location to a location where the concentration of a substance equals its "level of concern", which is generally defined as the concentration in air of a substance above which one could expect some level of impact to human health. (see 4.1.1).

For this analysis, the distance from the hypothetical release location to the location where the concentration of a substance equals its level of concern is calculated for all toxic substances analyzed. In addition, the concentration of each toxic substance (resulting from a release) is calculated at three points of interest. The distances to these points of interest for each of the homeport locations are listed below.

Table 3 - Estimated Distances to Points of Interest for Each Homeport (meters)

	NASNI	PSNS	NAVSTA Everett	PHNSY
Worker[1]	100	100	100	100
NPA[2]	152	182	270	353
MOI[3]	1189	526	372	936

Notes for Table 3:

1 - The worker represents an individual 100 meters from the release point. Although a worker could be closer than 100 meters from the release point, as is stated above, this is the closest (minimum calculable) distance that can be used to estimate hazardous substance concentration.

2 - The nearest public access individual, representing military personnel, civilian employees or their family members, including those that reside on base.

3 - The maximally exposed off-site individual, representing an individual living at the naval base boundary.

4.1.1 Level of Concern for Toxic Substances

To determine if a person's health could be affected by a release, the estimated concentration of a toxic substance at the specified distance from the hypothetical release location is compared to' a "level of concern." A level of concern is generally defined as the concentration in air of a substance above which one could expect some level of impact to human health.

For toxic substances regulated by 40 CFR 68, the level of concern is specified in Appendix A of 40 CFR 68. CCR Title 19 does not specify a level of concern for substances it regulates. For substances that are not regulated by 40 CFR 68, Emergency Response Planning Guideline (ERPG-2) values are used where available. The ERPG-2 value is defined by the American Industrial Hygiene Association as, "the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action."

Where ERPG-2 values have not been derived for a toxic substance, other values are used as follows:

a) One tenth of the Immediately Dangerous to Life and Health (IDLH) level published by the National Institute for Occupational Safety and Health. IDLH value is defined as, "conditions that pose an immediate threat to life or health, or conditions that pose an immediate threat of severe exposure to contaminants which are likely to have an adverse cumulative or delayed effect on health."

b) Where the one tenth IDLH value exceeds the permissible exposure limit (PEL), the PEL value is used. The PEL is a value specified by the Occupational Safety and Health Administration or an equivalent state agency. The PEL is based on exposures assuming an 8-hour work shift with a 40-hour workweek over a working lifetime with no adverse effects expected for most workers.

Table 4 below lists the level of concern and its basis for each of the toxic substances in this analysis.

Table 4 - Basis for the Level of Concern

	CAS No.	Level of Concern (mg/m^3)	Basis for the Level of Concern
Vinyl Acetate	108-05-4	260	40 CFR 68
Formaldehyde	50-00-O	12	40 CFR 68
Phenol	108-95-2	192	ERPG-2
Hydroquinone	123-31-9	5	IDLH/10
Naphtha	64742-95-6	457	IDLH/10
N-Butyl Alcohol	71-36-3	431	IDLH/10
Isopropyl Alcohol	67-63-O	980	PEL
Xvlene	1330-20-7	435	PEL

4.1.2 Cumulative Impact of Toxic Substances

Parameters and methods for estimating cumulative impact from exposure to multiple hazardous substances are not specified in 40 CFR 68, CCR Title 19, or references 8.1 and 8.2.

When substances in a mixture have similar toxicological effects, the cumulative impact from exposure to multiple hazardous substances can be estimated using the formula obtained from reference 8.3.

An estimated cumulative impact value of 1 or above indicates potential impact to human health. There are several factors affecting the uncertainty of cumulative impact values estimated using this method:

a) This method does not account for the release of all hazardous or inert substances in the source term, or as described in section 4.4.4, those created during a fire. That is, only those substances posing the highest risk to human health are accounted for in the estimated cumulative impact.

b) The levels of concern for substances without ERPG-2 values are typically conservative, inflating the cumulative impact values.

Due to the uncertainties described above, the extent of potential impact on human health (i.e., cumulative impact value 1 or greater) cannot be determined. Therefore, the results of estimated cumulative impact may only be used to assess whether or not impact to human health is possible as a result of a hypothetical accidental release scenario and cannot be used to quantify the extent of that impact.

4.1.3 Assumptions used in Model

4.1.3.1 Surface Roughness

40 CFR 68.22 requires use of urban or rural topography as appropriate. "Urban" means that there are many obstacles in the immediate area, including buildings and trees. "Rural" means there are no buildings in the immediate area and the terrain is generally flat and unobstructed. The terms "urban" and "rural" should not be confused with population density, since 40 CFR 68.22(e) defines them as indicators of "surface roughness". Since obstacles increase the dispersion capability of an airborne chemical plume, any analysis conducted assuming rural topography yields higher estimated concentrations of substances than one conducted assuming urban topography.

Consistent with 40 CFR 68.22, urban topography is assumed when performing calculations for the worker and nearest public access individual (NPA) since the worker and NPA are on land with topography meeting the definition of urban between those individuals and the release point. For the maximally-exposed offsite individual (MOI), separate calculations are performed assuming both rural and urban topographies since both types of topography (i.e. land and water) exist at each homeport location. Calculations to determine the distance to a level of concern are also performed assuming both rural and urban topographies.

4.1.3.2 Temperature and Vapor Pressure

For toxic liquids, 40 CFR 68.22(g) requires estimating the rate of release at the highest ambient temperature recorded in the past 3 years or the temperature of the liquid if normally used at an elevated temperature. This analysis goes beyond 40 CFR 68 requirements and assumes liquids are in pure form at their boiling points to remain consistent with the postulated fire scenario.

The rate of release of a pure substance or mixture of substances depends on vapor pressure[5] at the temperature of interest. The higher the vapor pressure of a substance, the faster it is released to the air. For any mixture, the vapor pressure of the mixture is the sum of the vapor pressures (called partial vapor pressures) of all the substances in the mixture. The partial vapor pressure of a substance is the product of its vapor pressure in pure form (at the temperature of interest) times its mole fraction in the mixture. Thus, the vapor pressure of an individual substance in a mixture is always less than the vapor pressure of the substance in pure form at any specified temperature. Therefore, the assumption that each hazardous substance is in pure form is conservative for substances that exist in mixtures.

4.1.3.3 Other Assumptions

- Worst-case wind speed is 1.5 m/s. 40 CFR 68.22(b).
- Atmospheric Stability Class F. 40 CFR 68.22(b).
- The rate of release of a toxic gas is the total quantity of gas divided by 10 minutes. 40 CFR 68.25(c). Formaldehyde is considered to be a gas for the purposes of this analysis, since it exists as a gas at temperatures equal to or above room temperature. In reality, it is dissolved in a liquid, which if accounted for in calculations, would yield a slower rate of release (less conservative).
- The rate of release of toxic liquids is estimated using a formula in reference 8.2, assuming the liquid is immediately spilled and forms a pool 1 cm deep per 40 CFR 68.25. The vapor pressure of a substance at its boiling point is equal to atmospheric pressure, 760 mm Hg.

4.2 Results of Toxic Substance Analysis

4.2.1 Distance to Level of Concern

The estimated distance to the level of concern for each substance is independent of location and therefore applicable to each homeport location. These results are illustrated on Table 5:

[5] The pressure exerted by a vapor in equilibrium with its solid or liquid phase.

Table 5 - Summary of Estimated Distances

HAZARDOUS SUBSTANCE	DISTANCE TO LEVEL OF CONCERN Rural Landscape (meters)	DISTANCE TO LEVEL OF CONCERN Urban Landscape (meters)
Formaldehyde	<100	<100
Vinyl Acetate	112	<100
Phenol	<100	<100
Hydroquinone	<100	<100
N-Butyl Alcohol	1015	242
Isopropyl Alcohol	459	117
Xylene	446	114
Naphtha	3494	664

These numbers represent the distances at which no serious health effect is expected assuming a release as stated in 3.3. The possible health effects within these distances are explained below for the five chemicals showing effect at a distance of 100 meters or greater. If these distances are compared with the distances to the individuals identified in Table 3, the results indicate that, assuming rural landscape conditions, the MOI, NPA, and worker would be affected at all locations from a release involving naphtha. It is important to recognize that naphtha is not a pure substance, but a mixture of many substances refined from petroleum. This mixture varies considerably from one manufacturer to the next.

Assuming rural landscape (flat land, no trees or buildings), n-butyl alcohol, isopropyl alcohol, and xylene would also impact both the worker and NPA at all locations. The significant difference in results between those assuming urban and rural topography is indicative of the uncertainty in the methods available for estimating consequences of an accidental release. All of the homeport locations have topographies that are combinations of rural and urban. However, this model can only be utilized assuming one or the other. Therefore, the results assuming rural topography are the most conservative and exceed any worst-case release.

Information on the toxic properties for the hazardous substances that dominate the toxic effects is provided below. This information was compiled from the EPA Integrated Risk Information System, and references 8.4 and 8.7:

Naphtha is a moderate irritant to the respiratory tract. Effects from inhalation include irritation of the eyes, skin, nose, and respiratory system, including possible visual distortion and cough. At higher levels, inhalation can cause unconsciousness that may go to coma, stentorious breathing, and bluish tint to the skin. Recovery follows removal from exposure. In mild form, intoxication resembles drunkenness. No minimum concentration where effects exist was reported in the references.

Isopropyl Alcohol is a moderate irritant to the respiratory tract, acting as a local irritant, and in high concentrations as a narcotic. At concentrations of 1000 mg/m^3, mild irritation of the eyes, nose and throat occurs. It can also cause drowsiness, dizziness, and headaches.

Xylene is a moderate irritant to the respiratory tract and eyes with very little skin toxicity. Some temporary corneal effects can occur. Irritation can start at concentrations of 880 mg/m^3. It can also cause dizziness, excitement, drowsiness, incoordination, staggering gait, anorexia, nausea, vomiting, abdominal pain, and dermatitis.

Vinyl Acetate is a moderate irritant to the respiratory tract and may act as a skin irritant. High concentrations of the vapor are narcotic. It may also cause irritation to the eyes, hoarseness, cough, loss of smell, eye burns, and skin blisters. No adverse health effects are expected from exposure to concentrations below 5 mg/m^3. Adverse effects could occur for concentrations as low as 19 mg/m^3. Both values are extrapolated from non-human experimental data.

n-Butyl Alcohol is a moderate irritant to the respiratory tract. Use of n-Butyl alcohol (chronic exposure to lower concentrations) has resulted in irritation of the eyes, slight headache and dizziness, slight irritation of the nose and throat, and dermatitis about the fingernails and along the sides of the fingers. It may also cause drowsiness, corneal inflammation, blurred vision, discharge of tears, photophobia, possible auditory nerve damage, hearing loss, and central nervous system depression. No minimum concentration where effects exist was reported.

4.2.2 Cumulative Impact

For each homeport location, the cumulative impact was estimated at the three points of interest identified in section 4.1. With two exceptions, the estimated cumulative impact for all homeport locations exceeded 1. As was the case with the analysis of individual substances (or mixtures in naphtha's case), naphtha was the largest contributor to the cumulative impact. For PSNS and Everett, assuming rural landscape, the concentration of naphtha at the maximally-exposed offsite individual (MOI) exceeds the IDLH level (see 4.1.1). Vinyl acetate, n-butyl alcohol, isopropyl alcohol, and xylene were also significant contributors. The tables showing calculations for each homeport location are in Enclosure D.

4.3 Conclusions

4.3.1 Conservatisms

These results are based on assumptions that are intentionally conservative to ensure that the consequences of any conceivable accidental release would be less than the consequences estimated by this analysis. Besides the assumptions in 4.1.3, such as wind speed and atmospheric stability factor, the following reiterates the intentionally conservative parameters and assumptions identified in earlier sections. While it is not mathematically possible to assign a value to define how these conservatisms impact the results, it is appropriate to conclude that the results of this analysis overstate the consequences of a worst possible accidental release; and this before any of the Navy's mitigation factors are taken into account to reduce the likelihood of a release:

a) Liquids are assumed to be released at their boiling points (see 4.1.3.2). This assumption is even more conservative than the requirements of 40 CFR 68, which require the release rate to be estimated assuming the highest ambient temperature recorded at the facility in the past 3 years.

b) Each hazardous substance is assumed to exist in pure form (see 4.1.3.2). Because most hazardous substances exist as mixtures and when spilled will form a new mixture, the actual rate of release of the hazardous substance will be significantly lower. The molecular interaction in liquid mixtures lowers the vapor pressure of each hazardous substance and thereby lowers the release rate.

c) The quantity of each hazardous substance is based on the total used for a PIA (see 3.2). As described in Enclosure C, the quantity of hazardous substances maintained for use in a flammable material storage locker is minimized and thus the source term (quantities) used for this analysis is higher than the largest quantity actually kept in a flammable material storage locker at any one time.

4.3.2 Significance of Results

The results of this analysis indicate that if an accidental release of hazardous substances were to occur at one of the homeport locations without mitigating measures in place, there could be a potential impact to human health. However, the Navy has mitigating measures in place at the homeport locations that minimize the possibility of such a release occurring, and minimize the impact if such a release occurs. These mitigating measures include administrative controls for safe handling of hazardous substances, personnel protective equipment, and emergency response programs involving established resources such as fire departments and emergency command centers. These mitigating measures are further described in section 6 and an example of procedures is described in Enclosure C.

For perspective, the quantities and types of hazardous substances listed and considered in this analysis are not unique to Navy operations. For example, one could encounter similar quantities of isopropyl alcohol in a drug store; n-butyl alcohol, naphtha, or xylene in a local paint store; or formaldehyde in a school biology lab.

4.4 Other Considerations

4.4.1 Effects to the Environment

40 CFR 68 and CCR Title 19 do not require a quantitative analysis of the consequences of an accidental release of hazardous substances to the environment. EPA noted the following in the June 20, 1996 Federal Register:

> "EPA agrees that extensive environmental analysis is not justified. Irreversible adverse effect exposure level data for the wide variety of environmental species potentially exposed in an accidental release event are not available for most of the listed substances. EPA believes that identification of potentially affected

environmental receptors in the risk management plan is sufficient for purposes of accident prevention, preparedness, and response by the source and at the local level."

40 CFR 68 and CCR Title 19 require identification of environmental receptors that could potentially be affected by an accidental release of hazardous substances. Environmental receptors are defined as, "natural areas such as national or state parks, forests, or monuments; officially designated wildlife sanctuaries, preserves, refuges, or areas; and Federal wilderness areas." These areas are discussed in the air quality sections of Volume I, Sections 3.10, 4.10, 5.10, and 6.10. The environments surrounding each location are similar. The following environmental receptors exist at all of the homeport locations:

a) Populations of threatened or endangered species as identified in Volume 1, Sections 3.5, 3.6, 4.5, 4.6, 5.5, 5.6, 6.5, and 6.6 of the EIS.
b) Salt water bays, marshes, and estuaries. These areas are critical for the survival of fish, birds, and other wildlife because they provide safe spawning grounds and nurseries.

4.4.2 Non-airborne Pathways

Another potential pathway for an accidental release of hazardous substances, other than an airborne release, is a spill into the receiving waters adjacent to the shore-based activity or a vessel under repair. As discussed by EPA (61 FR 31668), 40 CFR 68 is only applicable to (and only prescribes parameters and method of analysis for) airborne releases. The prediction of marine environmental effects from accidental waterborne releases of hazardous chemicals is difficult. Because of the complex nature of contaminant behavior, fate, toxicology and bioavailability and the large number of potential receptors, there are difficulties in attributing quantifiable biological effects from a hazardous chemical spill to the marine or estuarine environment. In addition, there is very little data available for most of the substances of concern on the impacts to human health and aquatic receptors via waterborne exposure. EPA has not developed water quality criteria for most of these compounds and very few are covered by State regulation for water releases. Few conclusions can be drawn as to quantifiable human or ecosystem health effects even though hydrodynamic/contaminant fate models can be used to predict the dilution, dispersion and fate of substances released into the marine environment.

Toxicology data from the US EPA Integrated Risk Information System (IRIS) was used to further classify suspected biological effects from exposure to those compounds of concern. Of the compounds and chemicals listed, several were classified as one or more of the following: carcinogen, teratogen, or mutagen. It should be noted, however, that these chemical toxicological classifications and effects are based predominantly on laboratory-based toxicity studies in small mammals as a substitute for human exposure and likely do not directly correlate to marine environmental exposure. It is also likely that they do not adequately predict effects at anticipated marine water concentrations for accidental releases. The overall lack of aquatic effects data is largely attributable to the fact that these compounds, with the exception of a few metals, typically are not associated with industrial discharge or stormwater runoff.

Although biological effects cannot be ascertained from existing data, there is the possibility of localized toxic effects on organisms in the vicinity of a spill. However, the severity of this effect is dependent upon the individual properties of the compound(s) released, the duration of exposure and site-specific conditions. Factors that can influence potential toxicity include, but are not limited to:

physical/chemical characteristics of the compound released (e.g. volatility and solubility)and amount released; physical characteristics of the receiving system such as temperature, pH and salinity; chemical fate such as partitioning, degradation and bioavailability; mode of toxicity and physical transport by tidal activity, winds or vessel movement which will determine initial dilution and dispersion. Quantitative site-specific impact analysis from waterborne pathways is not provided here because of the lack of appropriate toxicological data and relevant regulatory standards. As noted in Section 6, the Navy already has mitigating measures in place at the specified homeport locations to minimize the possibility of accidental hazardous substance release and to minimize impacts if such a release were to occur.

4.4.3 Long Term Effects

40 CFR 68 and CCR Title 19 do not address potential long-term effects, such as cancer, from acute exposure to toxic substances. There are methods specified by EPA (apart from 40 CFR 68) to estimate cancer risk from exposure to carcinogens, e.g., to determine cleanup criteria for a contaminated site. However, these methods are premised on continuous exposure over long periods of time (years). Analysis of toxic substances impact per 40 CFR 68 and CCR Title 19 is based on short-term (acute) exposure. The event described herein is a one-time incident of catastrophic proportions. Thus, this analysis does not include quantitative analysis of long term impact to human health.

4.4.4 Effects of a Fire

As was described in 4.1.3.2, this analysis assumes the hazardous substances are released at their boiling points. It is possible that instead of being released to the atmosphere in their pure form, hazardous substances could be burned, or undergo chemical reactions in the presence of elevated temperatures. Also, a fraction of the total quantity may undergo change in a fire to a different substance (e.g., carbon monoxide or other combustion products).

According to reference 8.8, "assessment of the overall physiological and behavioral effects of human exposure to fire and its combustion products is an extremely difficult and complex task," in part because the identity and quantity of combustion products depend on the nature of the fire (its heat, thermal distribution, and duration). To perform such an assessment on the scenario described in section 3.2, reference 8.8 states that "tests for the toxicity of smoke produced by burning material involve some quantitative measurement in the laboratory of the toxic potency." This analysis does not include quantitative analysis of the impacts of combustion products on human health and the environment since no such model exists.

In the event that some packaging materials (e.g., plastic) burn in a fire, exposure to the products of combustion would present numerous hazards to humans. Predominant among these effects are heat, impaired vision due to smoke density or eye irritation, narcosis from inhalation of asphyxiants, and irritation of the upper and/or lower respiratory tracts. These hazards are similar to those from fumes produced by burning polyvinyl structural materials and furnishings commonly found in modern office buildings and homes. Smoke from such fires would require personnel in the immediate vicinity to evacuate or don appropriate personal protective equipment.

4.4.5 Probability of Occurrence

40 CFR 1502.22 of the CEQ regulations implementing NEPA requires indication of the probability or improbability of an accident's occurrence. As was described in Volume 2, Appendix F, Section 2.6 and 3.2.1, the probability of occurrence of an event leading to a fire in the radiological support facilities is estimated to be in the range of $4x10^{-3}$ (1 in 250) to $5x10^{-3}$ (1 in 200) per year. For accidents that could result in a release of hazardous substances, a probability of $5x10^{-3}$ (1 in 200) per year was considered to be a reasonable upper level. This level was based on the probability that a structurally damaging industrial fire could occur.

4.4.6 Flammable Gases and Liquid Fuel

In addition to the hazardous substances used during a PIA, other flammable gases and liquid fuel are currently stored and distributed for normal operations at each of the homeport locations in areas separate from the hazardous material storage lockers. No additional infrastructure, that is, larger containers or increased quantity other than are used currently at each homeport location, is necessary to support CVN homeporting. Therefore, there is no change in conditions warranting analysis under NEPA.

5 ANALYSIS OF FLAMMABLE SUBSTANCES

5.1 Introduction

In addition to the effects due to exposure to toxic substances from a release, there are effects due to an accident involving flammable substances. 40 CFR 68 defines three methods for estimating the potential effects to human health resulting from an accident involving flammable substances:

a) An explosion - the distance to an overpressure of 1 psi is estimated. Overpressure is the increase in atmospheric pressure at a point when the blast pressure wave arrives at that point.

b) Radiant heat - radiant heat emitted from a fire that may cause burns.

c) Distance from the release point where the concentration of a flammable substance in air exceeds the lower flammability limit (i.e., the mixture could ignite).

Since reference 8.2 defines scenario a) above as the worst-case, an explosion has been chosen as the scenario for this analysis.

5.2 Method of Analysis

The following is an excerpt from reference 8.2, which describes the analysis of a worst-case release of flammable substances according to 40 CFR 68:

"For the worst-case scenario involving a release of flammable gases and volatile flammable liquids, the total quantity of the flammable substance is assumed to form a vapor cloud within the upper and lower flammability limits, and the cloud is assumed to detonate. As a conservative assumption, 10 percent of the flammable vapor in the cloud is assumed to participate in the explosion. You need to estimate the consequence distance to an overpressure level of 1 pound per square inch (psi) from the explosion of the vapor cloud. An overpressure of 1 psi may cause partial demolition of houses, which can result in serious injuries to people, and shattering of glass windows, which may cause skin laceration from flying glass."

The "consequence distance" (defined above) to an overpressure of 1 psi is estimated using formulas and data (i.e. heat of combustion) provided in attachment C of reference 8.2.

5.3 Results

The following are the estimated consequence distances to an overpressure of 1 psi for each substance individually and for all substances together (conservatively assuming all are simultaneously released). Thus the following results are applicable to all the homeport locations:

Table 6 - Results of Flammable Hazardous Substance Analysis

SUBSTANCE	ESTIMATED CONSEQUENCE DISTANCE TO AN OVERPRESSURE OF 1 psi (meters)
Isobutane	16
Propane	37
Pentane	50
Dimethyl Ether	48
Total [1]	66

Notes for Table 6:

1 - The total represents the total weight of all substances and a calculated heat of combustion for the mixture. The heat of combustion of a mixture is the sum of each constituent's weight percentage (in the mixture) times its heat of combustion.

Table 7 illustrates that assuming worst-case parameters, members of the public are at least twice the distance from the point of release than a distance where injuries as a result of an explosion are likely to occur. A person closer than 66 meters from the release point (i.e., a worker) may sustain injuries as a result of an explosion.

Table 7 - Comparison of Estimated Consequence Distance to Distances of Interest

Homeport Location	Distance to Nearest Public Access Individual [1] (meters)	Distance to Maximally Exposed Off-Site Individual [2] (meters)	Estimated Consequence Distance to an Overpressure of 1 psi (meters) [3]
PSNS	182	526	66
NAVSTA Everett	270	372	66
NASNI	152	1189	66
PHNSY	353	936	66

Notes for table 7:

1 - The nearest public access individual, representing military personnel, civilian employees or their family members, including those that reside on base.

2 - The maximally exposed off-site individual, representing an individual living at the naval base boundary.

3 - This distance represents the combined effect of an accident involving all of the flammable substances.

5.4 Conclusion

The conclusions drawn from the analysis results are conservative since the quantity of each hazardous substance is based on the total used for a PIA. As described in Enclosure A, the quantity of hazardous substances staged in a flammable material storage locker is minimized and thus the total quantities used for this analysis will exceed the largest quantity actually kept in a flammable material storage locker. In addition, since these flammable materials are packaged in small containers (for example, spray cans) it is unlikely that the total quantity of material would ignite at one time. The results of the flammable substance analysis shown in table 7 indicate that no impact to human health to the public is expected from a hypothetical release.

5.5 Other Considerations

The other considerations described in section 4.4 for analysis of toxic substances apply to this analysis of flammable substances.

6 EXISTING MITIGATING MEASURES

All of the homeport locations currently support maintenance of Navy ships and facilities, and therefore already have management controls in place for safe management of hazardous substances. Enclosure C describes an example of these management controls as implemented by the Navy. These management controls mitigate the opportunity for a release to occur.

The analysis results presented in sections 4 and 5 were derived conservatively assuming no mitigating measures exist. The following summarizes the existing mitigating measures at each of the homeport locations:

- Hazardous substances are controlled from the time they are ordered until they no longer require control under hazardous material management practices or are properly disposed of as hazardous waste.
- Hazardous substances are only stored in flammable material storage lockers specifically designed to minimize the opportunity for an accidental release. The most significant features of these lockers are:
  - Secondary containment of material, including an impervious floor and sump
  - Walls and sump constructed of heavy-gauge steel
  - Fire suppression system (note that a fire originating inside the locker would be smothered from lack of oxygen, by design, in addition to effects of the fire suppression system)
  - Underwriters Laboratory (UL) classified, non-combustible construction
  - Door equipped with self closer
  - Static grounding system (minimizes the potential of a spark igniting a flammable substance)
  - Hazard placards and labeling
- Emergency response programs exist at all homeport locations. These programs involve warning communications, fire departments, emergency command centers, and written plans for responding to accidental releases. Emergency response drills are conducted periodically. These programs ensure prompt response and clean-up of any accidental release.
- In accordance with federal worker right-to-know laws, all employees receive applicable training regarding safe handling of hazardous substances.
- Personnel who manage hazardous substances are trained to properly utilize personnel protective equipment (rubber boots, gloves, eye protection, and respirators). Procedures specify personnel protective equipment that must be worn when handling hazardous substances.

7 Conclusion

The methodology used to conduct this analysis is consistent with EPA regulations and published guidance. The parameters of this analysis are intentionally conservative to ensure application of this analysis to all of the homeport locations. In addition, this analysis is conducted assuming that none of the mitigating measures that currently exist at all Navy facilities (and will exist at any new CVN homeport location) are in place.

The results of the toxic substance analysis, using these conservative assumptions, indicate that if an accident involving a release of hazardous substances were to occur at one of the homeport locations without currently established mitigating measures in place, there could be a potential impact to human health. The results of the flammable substance analysis indicate that no impact to human health is expected from a hypothetical accidental release. However, given the Navy's existing mitigating measures, the possibility of such an accident causing significant health or environmental impact is negligible.

8 REFERENCE MATERIALS

8.1 Technical Guidance for Hazards Analysis; U. S. Environmental Protection Agency, Federal Emergency Management Agency, U. S. Department of Transportation; December 1987.

8.2 RMP Offsite Consequence Analysis Guidance; U. S. Environmental Protection Agency, May 1996.

8.3 Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A); U. S. Environmental Protection Agency, 1989.

8.4 NIOSH Pocket Guide to Chemical Hazards; National Institute for Occupational Safety and Health, June 1994.

8.5 Emergency Response Planning Guidelines and Workplace Environmental Exposure Level Guides Handbook; American Industrial Hygiene Association, 1997.

8.6 Lewis Sr., Richard J. Hawley's Condensed Chemical Dictionary. Van Nostrand Reinhold Company, New York, 1993.

8.7 Sax, Irving J. Dangerous Properties of Industrial Materials. Van Nostrand Reinhold Company, New York, 1996.

8.8 Cote, Arthur E. Fire Protection Handbook. National Fire Protection Association, Quincy, Massachusetts, 1992.

Enclosure A

BACKGROUND OF FEDERAL AND STATE REGULATIONS

A-1. Public awareness of the potential danger from accidental releases of hazardous substances has increased as serious chemical accidents have occurred around the world. A 1974 explosion in England, a 1976 release of dioxin in Italy, and a 1984 release of methyl isocyanate in Bhopal, India are examples of such incidents. In response to this public awareness, the U. S. Environmental Protection Agency (EPA) began its Chemical Emergency Preparedness Program (CEPP) in 1985. CEPP was a voluntary program to encourage state and local authorities to identify hazards in their local areas and to plan for chemical emergency response actions.

A-2. In 1986, Congress enacted many elements of the CEPP in the Emergency Planning and Community Right-to-Know Act (EPCRA). EPCRA required states to establish state and local emergency planning groups to develop chemical emergency response plans for each community. Although individual facilities were required to provide information on hazardous chemicals they had on site, they were not mandated to establish accident prevention programs.

A-3. On June 20, 1996, EPA promulgated regulations (40 CFR 68) required by the Clean Air Act (CAA) Amendments of 1990 [section 112(r)] designed to prevent accidental releases of regulated substances to the air. In the Federal Register (61 FR 31668) EPA declared, "The intent of section 112(r) is to prevent accidental releases to the air and mitigate the consequences of such releases by focusing prevention measures on chemicals that pose the greatest risk to the public and the environment." A total of 77 toxic substances and 63 flammable substances are regulated by 40 CFR 68 at stationary sources (facilities) that use greater than a threshold quantity of the regulated substance in a process. 40 CFR 68.130 identifies the regulated substances and their threshold quantities. Tables 1 and 2 list these regulated substances.

A-4. On June 30, 1997, the California Office of Emergency Services (OES) issued emergency regulations designed to prevent accidental releases of regulated substances to the air (CCR Title 19, Division 2, Chapter 4.5). Pursuant to Senate Bill 1889, OES is required to adopt implementing regulations, initially as emergency regulations, and to seek and maintain delegation of the federal program. Adoption of the emergency regulations as final rule and delegation of the federal program to OES were not complete as of February 1, 1998.

A-4.1 With some exceptions, the EPA and OES regulations are equivalent. One exception is that the OES regulations contain a larger list of regulated toxic substances with different threshold quantities. Table 3 shows the CCR Title 19 list of toxic chemicals.

A-4.2 The other two states with potential homeport sites, Washington and Hawaii, do not have separate state regulations for prevention of accidental release of regulated substances. For these states, 40 CFR 68 applies.

A-5. Stationary sources (facilities) with more than a threshold quantity of a regulated substance must develop and implement a risk management program. Lists in 40 CFR 68 and CCR Title 19 specify the threshold quantity assigned by EPA and OES to each regulated substance. There are three main components of the risk management program: a hazard assessment, a prevention program, and an emergency response program. The risk management program must be described in a risk management plan registered with EPA or OES, submitted to state and local authorities, and made available to the public.

A-6. A hazard assessment consists of two parts:

a) The estimation of consequences from accidental release of regulated substances.

b) The compilation of a 5-year accident history for all accidental releases that have resulted in physical injury, property damage, or environmental damage.

A-7. Information gained from the hazard assessment is used to create an accidental release prevention program and an emergency response plan. The extent of the accidental release prevention program and emergency response plan are dependent on the results of the hazard assessment.

A-8. The estimation of consequences portion of a hazard assessment conducted per 40 CFR 68 and CCR Title 19 requires analysis of a "worst-case" release scenario for toxic and flammable substances that exceed the threshold quantity in a process. "Worst-case" means that analysis parameters represent the most conservative conditions (e.g., weather) and a lack of immediate mitigation. For facilities with a history of accidents, 40 CFR 68 and CCR Title 19 require analysis of alternative (more likely to occur) scenarios.

A-9. 40 CFR 68 and CCR Title 19 require:

a) For toxic substances, estimating the maximum distance from the point of release to the location in any direction where the concentration of the regulated substance equals or exceeds a level of concern. (See section 4.1.1 for definition of level of concern.)

b) For some cases, an alternative analyses for toxic substances using the same method as the worst case analysis but applying less conservative, more probable parameters.

c) For flammable substances, estimating the distance from the point of release to the location in any direction where an overpressure of 1 psi would result from an explosion. (See section 5.1 for definition of overpressure.)

d) For some cases, an alternative analyses for flammable substances estimating the distance from the release point where an explosive mixture of the substance exists or an evaluation of radiant heat effects.

Enclosure A
(continued)

Table 1 LIST OF 40 CFR 68 REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES (Table 2 of 40 CFR 68.130)

CAS No.	Chemical Name	Threshold Quantity (lb)
50-00-0	Formaldehyde (solution)	15,000
57-14-7	1,1-Dimethylhydrazine [Hydrazine,1,1-dimethyl-]	15,000
60-34-4	Methyl hydrazine [Hydrazine, methyl-]	15,000
67-66-3	Chloroform [Methane, trichloro-]	20,000
74-87-3	Methyl chloride [Methane, chloro-]	10,000
74-90-8	Hydrocyanic acid	2,500
74-93-1	Methyl mercaptan [Methanethiol]	10,000
75-15-0	Carbon disulfide	20,000
75-21-8	Ethylene oxide [Oxirane]	10,000
75-44-5	Phosgene [Carbonic dichloride]	500
75-55-8	Propyleneimine [Aziridine, 2-methyl-]	10,000
75-56-9	Propylene oxide [Oxirane, methyl-]	10,000
75-74-1	Tetramethyllead [Plumbane, tetramethyl-]	10,000
75-77-4	Trimethylchlorosilane [Silane, chlorotrimethyl-]	10,000
75-78-5	Dimethyldichlorosilane [Silane, dichlorodimethyl-]	5,000
75-79-6	Methyltrichlorosilane [Silane, trichloromethyl-]	5,000
78-82-0	Isobutyronitrile [Propanenitrile, 2-methyl-]	20,000
79-21-0	Peracetic acid [Ethaneperoxoic acid]	10,000
79-22-1	Methyl chloroformate[Carbonochloridic acid, methylester]	5,000
91-08-7	Toluene 2,6-diisocyanate [Benzene, 1,3-diisocyanato-2-methyl-]	10,000
106-89-8	Epichlorohydrin [Oxirane,	20,000
107-02-8	Acrolein [2-Propenal]	5,000
107-11-9	Allylamine [2-Propen-1-amine]	10,000
107-12-0	Propionitrile [Propanenitrile]	10,000
107-13-1	Acrylonitrile [2-Propenenitrile]	20,000
107-15-3	Ethylenediamine [1,2-Ethanediamine]	20,000
107-18-6	Allyl alcohol [2-Propen-1-ol]	15,000
107-30-2	Chloromethyl methyl ether [Methane, chloromethoxy-]	5,000
108-05-4	Vinyl acetate monomer [Acetic acid ethenyl ester]	15,000
108-23-6	Isopropyl chloroformate [Carbonochloridic acid, 1-methylethyl ester]	15,000
108-91-8	Cyclohexylamine [Cyclohexanamine]	15,000
109-61-5	Propyl chloroformate [Carbonochloridic acid, propylester]	15,000
110-00-9	Furan	5,000
110-89-4	Piperidine	15,000
123-73-9	Crotonaldehyde, (E)- [2-Butenal, (E)-]	20,000
126-98-7	Methacrylonitrile [2-Propenenitrile, 2-methyl-]	10,000
151-56-4	Ethyleneimine [Aziridine]	10,000
302-01-2	Hydrazine	15,000
353-42-4	Boron trifluoride compound with methyl ether (1:1) [Boron, trifluoro[oxybis[methane]]-, T-4-	15,000
506-77-4	Cyanogen chloride	10,000
509-14-8	Tetranitromethane [Methane, tetranitro-]	10,000
542-88-1	Chloromethyl ether [Methane, oxybis[chloro-]	1,000
556-64-9	Methyl thiocyanate [Thiocyanic acid, methyl ester]	20,000
584-84-9	Toluene 2,4-diisocyanate [Benzene, 2,4-diisocyanato-1-methyl-]	10,000
594-42-3	Perchloromethylmercaptan [Methanesulfenyl chloride, trichloro-]	10,000
624-83-9	Methyl isocyanate [Methane, isocyanato-]	10,000
814-68-6	Acrylyl chloride [2-Propenoyl chloride]	5,000

Enclosure A
(continued)

CAS No.	Chemical Name	Threshold Quantity (lb)
4170-30-3	Crotonaldehyde [2-Butenal]	20,000
7446-09-5	Sulfur dioxide (anhydrous)	5,000
7446-11-9	Sulfur trioxide	10,000
7550-45-0	Titanium tetrachloride [Titanium chloride (TiCl(4)) (T-4)-]	2,500
7637-07-2	Boron trifluoride [Borane, trifluoro-]	5,000
7647-01-0	Hydrochloric acid (conc 37% or greater)	15,000
7647-01-0	Hydrogen chloride (anhydrous) [Hydrochloric acid]	5,000
7664-39-3	Hydrogen fluoride/Hydrofluoric acid (conc 50% or greater) [Hydrofluoric acid]	1,000
7664-41-7	Ammonia (anhydrous)	10,000
7664-41-7	Ammonia (conc 20% or greater)	20,000
7697-37-2	Nitric acid (conc 80% or greater)	15,000
7719-12-2	Phosphorus trichloride [Phosphorous trichloride]	15,000
7726-95-6	Bromine	10,000
7782-41-4	Fluorine	1,000
7782-50-5	Chlorine	2,500
7783-06-4	Hydrogen sulfide	10,000
7783-07-5	Hydrogen selenide	500
7783-60-0	Sulfur tetrafluoride [Sulfur fluoride (SF(4)), (T-4)-]	2,500
7784-34-1	Arsenous trichloride	15,000
7784-42-1	Arsine	1,000
7803-51-2	Phosphine	5,000
8014-95-7	Oleum (Fuming Sulfuric acid) [Sulfuric acid, mixture with sulfur trioxide]	10,000
10025-87-3	Phosphorus oxychloride [Phosphoryl chloride]	5,000
10049-04-4	Chlorine dioxide [Chlorine oxide (ClO(2))]	1,000
10102-43-9	Nitric oxide [Nitrogen oxide (NO)]	10,000
10294-34-5	Boron trichloride [Borane, trichloro-]	5,000
13463-39-3	Nickel carbonyl	1,000
13463-40-6	Iron, pentacarbonyl- [Iron carbonyl (Fe(CO)(5)), (TB-5-11)-]	2,500
19287-45-7	Diborane	2,500
26471-62-5	Toluene diisocyanate (unspecified isomer) [Benzene, 1,3-diisocyanatomethyl-1]	10,000

Enclosure A
(continued)

Table 2 LIST OF 40 CFR 68 REGULATED FLAMMABLE SUBSTANCES AND THRESHOLD QUANTITIES (Table 4 of 40 CFR 68.130)

CAS No.	Chemical Name	Threshold Quantity (lb)
60-29-7	Ethyl ether [Ethane, 1,1'-oxybis-]	10,000
74-82-8	Methane	10,000
74-84-0	Ethane	10,000
74-85-1	Ethylene [Ethene]	10,000
74-86-2	Acetylene [Ethyne]	10,000
74-89-5	Methylamine [Methanamine]	10,000
74-98-6	Propane	10,000
74-99-7	Propyne [1-Propyne]	10,000
75-00-3	Ethyl chloride [Ethane, chloro-]	10,000
75-01-4	Vinyl chloride [Ethene, chloro-]	10,000
75-02-5	Vinyl fluoride [Ethene, fluoro-]	10,000
75-04-7	Ethylamine [Ethanamine]	10,000
75-07-0	Acetaldehyde	10,000
75-08-1	Ethyl mercaptan [Ethanethiol]	10,000
75-19-4	Cyclopropane	10,000
75-28-5	Isobutane [Propane, 2-methyl]	10,000
75-29-6	Isopropyl chloride [Propane, 2-chloro-]	10,000
75-31-0	Isopropylamine [2-Propanamine]	10,000
75-35-4	Vinylidene chloride [Ethene, 1,1-dichloro-]	10,000
75-37-6	Difluoroethane [Ethane, 1,1-difluoro-]	10,000
75-38-7	Vinylidene fluoride [Ethene, 1,1-difluoro-]	10,000
75-50-3	Trimethylamine [Methanamine, N,N-dimethyl-]	10,000
75-76-3	Tetramethylsilane [Silane, tetramethyl-]	10,000
78-78-4	Isopentane [Butane, 2-methyl-]	10,000
78-79-5	Isoprene [1,3,-Butadiene, 2-methyl-]	10,000
79-38-9	Trifluorochloroethylene [Ethene, chlorotrifluoro-]	10,000
106-97-8	Butane	10,000
106-98-9	1-Butene	10,000
196-99-0	1,3-Butadiene	10,000
107-00-6	Ethyl acetylene [1-Butyne]	10,000
107-01-7	2-Butene	10,000
107-25-5	Vinyl methyl ether [Ethene, methoxy-]	10,000
107-31-3	Methyl formate [Formic acid, methyl ester]	10,000
109-66-0	Pentane	10,000
109-67-1	1-Pentene	10,000
109-92-2	Vinyl ethyl ether [Ethene, ethoxy-]	10,000
109-95-5	Ethyl nitrite [Nitrous acid, ethyl ester]	10,000
115-07-1	Propylene [1-Propene]	10,000
115-10-6	Methyl ether [Methane, oxybis-]	10,000
115-11-7	2-Methylpropene [1-Propene, 2-methyl-]	10,000
116-14-3	Tetrafluoroethylene [Ethene, tetrafluoro-]	10,000
124-40-3	Dimethylamine [Methanamine, N-methyl-]	10,000
460-19-5	Cyanogen [Ethanedinitrile]	10,000
463-49-0	Propadiene [1,2-Propadiene]	10,000
463-58-1	Carbon oxysulfide [Carbon oxide sulfide (COS)]	10,000
463-82-1	2,2-Dimethylpropane [Propane, 2,2-dimethyl-]	10,000
504-60-9	1,3-Pentadiene	10,000
557-98-2	2-Chloropropylene [1-Propene, 2-chloro-]	10,000

Enclosure A
(continued)

CAS No.	Chemical Name	Threshold Quantity (lb)
563-45-1	3-Methyl-1-butene	10,000
563-46-2	2-Methyl-1-butene	10,000
590-18-1	2-Butene-cis	10,000
590-21-6	1-Chloropropylene [1-Propene, 1-chloro-]	10,000
598-73-2	Bromotrifluorethylene [Ethene, bromotrifluoro-]	10,000
624-64-6	2-Butene-trans [2-Butene, (E)]	10,000
627-20-3	2-Pentene, (Z)-	10,000
646-04-8	2-Pentene, (E)-	10,000
689-97-4	Vinyl acetylene [1-Buten-3-yne]	10,000
1333-74-0	Hydrogen	10,000
4109-96-0	Dichlorosilane [Silane, dichloro-]	10,000
7791-21-1	Chlorine monoxide [Chlorine oxide]	10,000
7803-62-5	Silane	10,000
10025-78-2	Trichlorosilane [Silane, trichloro-]	10,000
25167-67-3	Butene	10,000

Table 3 STATE OF CALIFORNIA REGULATED SUBSTANCES LIST AND THRESHOLD QUANTITIES

(Table 3 to California Regulations Title 19, Division 2, Chapter 4.5, Article 8)

CAS No.	Chemical Name	Threshold Quantity (lb)
50-00-0	Formaldehyde[2]	500
50-07-7	Mitomycin C	500/10,000[1]
50-14-6	Ergocalciferol	1,000/10,000[1]
51-21-8	Fluorouracil	500/10,000[1]
51-75-2	Nitrogen Mustard [Mechlorethamine]	100/10,000[1]
51-83-2	Carbachol Chloride	500/10,000[1]
54-62-6	Aminopterin	500/10,000[1]
56-25-7	Cantharidin	100/10,000[1]
56-72-4	Coumaphos	100/10,000[1]
57-14-7	Dimethylhydrazine [Dimethylhydrazine]; 1,1-	1,000
57-24-9	Strychnine	100/10,000[1]
57-47-6	Physostigmine	100/10,000[1]
57-57-8	beta-Propiolactone	500
57-64-7	Physostigmine, Salicylate (1:1)	100/10,000[1]
58-36-6	Phenoxarsine, 10,10'-oxydi-	500/10,000[1]
58-89-9	Lindane [Hexachlorocyclohexane (Gamma Isomer)]	1,000/10,000[1]
59-88-1	Phenylhydrazine Hydrochloride	1,000/10,000[1]
60-34-4	Methyl Hydrazine	500
60-41-3	Strychnine, Sulfate	100/10,000[1]
60-51-5	Dimethoate	500/10,000[1]
62-38-4	Phenylmercury Acetate[Phenylmercuric Acetate]	500/10,000[1]
62-53-3	Aniline	1,000
62-74-8	Sodium Fluoroacetate [Fluoroacetic acid, sodium salt]	10/10,000[1]
64-00-6	Phenol, 3-(1-Methylethyl)-,Methylcarbamate	500/10,000[1]
64-86-8	Colchicine	10/10,000[1]
65-30-5	Nicotine Sulfate	100/10,000[1]
66-81-9	Cycloheximide	100/10,000[1]
67-66-3	Chloroform	10,000
70-69-9	Propiophenone, 4'-Amino-	100/10,000[1]
71-63-6	Digitoxin	100/10,000[1]
72-20-8	Endrin	500/10,000[1]
74-83-9	Methyl Bromide [Bromomethane]	1,000
74-90-8	Hydrogen Cyanide [Hydrocyanic Acid], (Gas)	100
74-93-1	Methyl Mercaptan [Methanethiol] [Thiomethanol]	500
75-15-0	Carbon Disulfide	10,000
75-21-8	Ethylene Oxide [Oxirane]	1,000
75-44-5	Phosgene [Carbonyl Chloride] [Carbonic Dichloride]	10
75-55-8	Propyleneimine [2-Methylaziridine]	10,000
75-56-9	Propylene Oxide [Methyloxirane]	10,000
75-74-1	Tetramethyllead [Tetramethylplumbane]	100
75-77-4	Trimethylchlorosilane [Chlorotrimethylsilane]	1,000
75-78-5	Dimethyldichlorosilane	500
75-79-6	Methyltrichlorosilane [Trichloromethylsilane]	500
75-86-5	Acetone Cyanohydrin	1,000
77-78-1	Dimethyl sulfate	500
77-81-6	Tabun [Ethyl dimethylamidocyanophosphate]	10
78-82-0	Isobutyronitrile [2-Methylpropanenitrile]	1,000

Enclosure A
(continued)

CAS No.	Chemical Name	Threshold Quantity (lb)
78-94-4	Methyl Vinyl Ketone	10
79-06-1	Acrylamide	1,000/10,000 [1]
79-11-8	Chloroacetic Acid	100/10,000 [1]
79-19-6	Thiosemicarbazide	100/10,000 [1]
79-21-0	Peracetic Acid [Ethaneperoxioic Acid] [Peroxyacetic Acid]	500
79-22-1	Methyl Chloroformate [Carbonochloridic Acid, Methyl Ester]	500
80-63-7	Methyl 2-Chloroacrylate	500
81-81-2	Warafarin	500/10,000 [1]
82-66-6	Diphacinone	10/10,000 [1]
86-50-0	Azinphos-Methyl [Guthion]	10/10,000 [1]
86-88-4	ANTU [1-Naphthalenylthiourea]	500/10,000 [1]
88-85-7	Dinoseb	100/10,000 [1]
91-08-7	Toluene 2,6-Diisocyanate [1,3-Diisocyanato-2-methylbenzene]	100
95-48-7	Cresol, o-	1,000/10,000 [1]
98-05-5	Benzenearsonic Acid	10/10,000 [1]
98-07-7	Benzotrichloride [Benzoic trichloride]	100
98-95-3	Nitrobenzene	10,000
99-98-9	Dimethyl-p-Phenylenediamine	10/10,000 [1]
100-14-1	Benzene, 1-(Chloromethyl)-4-Nitro-	500/10,000 [1]
102-36-3	Isocyanic Acid, 3,4-Dichlorophenyl Ester	500/10,000 [1]
103-85-5	Phenylthiourea	100/10,000 [1]
106-89-8	Epichlorohydrin [(Chloromethyl)Oxirane]	1,000
106-96-7	Propargyl Bromide [3-Bromopropyne]	10
107-02-8	Acrolein [2-Propenal]	500
107-11-9	Allylamine [P-Propen-1-amine]	500
107-12-0	Propionitrile [Propanenitrile] [Ethyl Cyanide]	500
107-13-1	Acrylonitrile [2-Propenenitrile]	10,000
107-15-3	Ethylenediamine [1,2-Ethanediamine]	10,000
107-18-6	Allyl Alcohol [2-Propen-1-ol]	1,000
107-30-2	Chloromethyl Methyl Ether [Chloromethoxymethane]	100
107-44-8	Sarin	10
108-05-4	Vinyl Acetate Monomer [Vinyl acetate] [Acetic acid, ethenyl ester]	1,000
108-23-6	Isopropyl Chloroformate [Carbonochloridic acid, 1-methylethyl ester]	1,000
108-91-8	Cyclohexylamine [Cyclohexanamine]	10,000
108-95-2	Phenol	500/10,000 [1]
109-61-5	Propyl Chloroformate [Carbonochloridic Acid, Propylester]	500
109-77-3	Malononitrile	500/10,000 [1]
110-00-9	Furan	500
110-89-4	Piperidine	1,000
115-29-7	Endosulfan	10/10,000 [1]
116-06-3	Aldicarb	100/10,000 [1]
123-31-9	Hydroquinone [4]	500/10,000 [1]
123-73-9	Crotonaldehyde [(E)-2-Butenal]; (E)-	1,000
124-65-2	Sodium Cacodylate	100/10,000 [1]
124-87-8	Picrotoxin	500/10,000 [1]
126-98-7	Methacrylonitrile [Methyl acrylonitrile] [2-Methyl-2-propenenitrile]	500
129-00-0	Pyrene	1,000/10,000 [1]
129-06-6	Warfarin Sodium [Coumadin] (Sodium salt)	100/10,000 [1]
143-33-9	Sodium Cyanide (Na(CN))	100
144-49-0	Fluoroacetic Acid	10/10,000 [1]
151-38-2	Methoxyethylmercuric Acetate	500/10,000 [1]
151-50-8	Potassium Cyanide	100

Enclosure A
(continued)

CAS No.	Chemical Name	Threshold Quantity (lb)
151-56-4	Ethyleneimine [Azirdine]	500
297-78-9	Isobenzan	100/10,000 [1]
298-00-0	Methyl Parathion [Parathion Methyl]	100/10,000 [1]
298-02-2	Phorate	10
298-04-4	Disulfoton	500
302-01-2	Hydrazine	1,000
309-00-2	Aldrin	500/10,000 [1]
315-18-4	Mexacarbate	500/10,000 [1]
316-42-7	Emetine, Dihydrochloride	1/10,000 [1]
327-98-0	Trichloronate	500
353-42-4	Boron Trifluoride Compound With Methyl Ether (1:1)	1,000
359-06-8	Fluoroacetyl Chloride	10
371-62-0	Ethylene Fluorohydrin	10
379-79-3	Ergotamine Tartrate	500/10,000 [1]
465-73-6	Isodrin	100/10,000 [1]
502-39-6	Methylmercuric Dicyanamide	500/10,000 [1]
504-24-5	Pyridine, 4-Amino-	500/10,000 [1]
505-60-2	Mustard Gas [2,2'-Dichloroethyl Sulfide]	500
506-61-6	Potassium Silver Cyanide	500
506-68-3	Cyanogen Bromide	500/10,000 [1]
506-78-5	Cyanogen Iodide	1,000/10,000 [1]
509-14-8	Tetranitromethane	500
514-73-8	Dithiazanine Iodide	500/10,000 [1]
534-07-6	Bis(Chloromethyl) Ketone	10/10,000 [1]
534-52-1	Dinitrocresol [4,6-Dinitro-o -Cresol]	10/10,000 [1]
535-89-7	Crimidine	100/10,000 [1]
541-25-3	Lewisite [Chlorovinylarsine Dichloride]	10
541-53-7	Dithiobiuret	100/10,000 [1]
542-88-1	Chloromethyl Ether	100
555-77-1	Tris(2-Chloroethyl)Amine	100
556-61-6	Methyl Isothiocyanate	500
556-64-9	Methyl Thiocyanate	10,000
558-25-8	Methanesulfonyl Fluoride	1,000
563-41-7	Semicarbazide Hydrochloride	1,000/10,000 [1]
584-84-9	Toluene 2,4-Diisocyanate [2,4,Diisocyanato-1-methylbenzene]	500
594-42-3	Perchloromethylmercaptan [Trichloromethanesulfonyl Chloride]	500
614-78-8	Thiourea, (2-Methylphenyl)-	500/10,000 [1]
624-83-9	Methyl Isocyanate [Isocyanatomethane]	500
630-60-4	Ouabain	100/10,000 [1]
639-58-7	Triphenyltin Chloride	500/10,000 [1]
640-19-7	Fluoroacetamide	100/10,000 [1]
644-64-4	Dimetilan	500/10,000 [1]
675-14-9	Cyanuric Fluoride	100
676-97-1	Methyl Phosphonic Dichloride	100
696-28-6	Phenyldichloroarsine [Dichlorophenylarsine] [Lewisite Variant]	500
732-11-6	Phosmet	10/10,000 [1]
814-68-6	Acrylyl Chloride [2-Propenoyl Chloride]	100
824-11-3	Trimethylolpropane Phosphite	100/10,000 [1]
900-95-8	Stannane, Acetoxytriphenyl-	500/10,000 [1]
920-46-7	Methacryloyl Chloride	100
947-02-4	Phosfolan	100/10,000 [1]
950-37-8	Methidathion	500/10,000 [1]

Enclosure A
(continued)

CAS No.	Chemical Name	Threshold Quantity (lb)
991-42-4	Norbormide	100/10,000 [1]
998-30-1	Triethoxysilane	500
999-81-5	Chlormequat Chloride	100/10,000 [1]
1031-47-6	Triamiphos	500/10,000 [1]
1066-45-1	Trimethyltin Chloride	500/10,000 [1]
1124-33-0	Pyridine, 4-Nitro-,1-Oxide	500/10,000 [1]
1129-41-5	Metolcarb	100/10,000 [1]
1303-28-2	Arsenic Pentoxide	100/10,000 [1]
1306-19-0	Cadmium Oxide	100/10,000 [1]
1314-62-1	Vanadium Pentoxide	100/10,000 [1]
1314-84-7	*Zinc Phosphide*	500
1327-53-3	Arsenous Oxide [Arsenic Troxide]	100/10,000 [1]
1397-94-0	Antimycin A	1,000/10,000 [1]
1420-07-1	Dinoterb	500/10,000 [1]
1464-53-5	Diepoxybutane	500
1558-25-4	Trichloro(Chloromethyl)Silane	100
1563-66-2	Carbofuran	10/10,000 [1]
1600-27-7	Mercuric Acetate	500/10,000 [1]
1752-30-3	Acetone Thiosemicarbazide	1,000/10,000 [1]
1910-42-5	Paraquat [Paraquat Dichloride]	10/10,000 [1]
1982-47-4	Chloroxuron	500/10,000 [1]
2001-95-8	Valinomycin	1,000/10,000 [1]
2032-65-7	Methiocarb [Mercaptodimethur]	500/10,000 [1]
2074-50-2	Paraquat Methosulfate	10/10,000 [1]
2097-19-0	*Phenylsilatrane*	*100/10,000* [1]
2104-64-5	EPN [Phenylphosphonothioic Acid o-Ethyl o-(4-Nitrophenyl)Ester]	100/10,000 [1]
2223-93-0	Cadmium Stearate	1,000/10,000 [1]
2231-57-4	Thiocarbazide	1,000/10,000 [1]
2275-18-5	Prothoate	100/10,000 [1]
2570-26-5	Pentadecylamine	100/10,000 [1]
2631-37-0	Promecarb	500/10,000 [1]
2642-71-9	Azinphos-Ethyl	100/10,000 [1]
2757-18-8	Thallous Malonate [Thallium Malonate]	100/10,000 [1]
2763-96-4	Muscimol [5-(Aminomethyl)-3-Isoxazolol]	500/10,000 [1]
2778-04-3	Endothion	500/10,000 [1]
3615-21-2	Benzimidazole, 4,5-Dichloro-2- (Trifluoromethyl)-	500/10,000 [1]
3691-35-8	Chlorophacinone	100/10,000 [1]
3734-97-2	Amiton Oxalate	100/10,000 [1]
3878-19-1	*Fuberidazole*	*100/10,000* [1]
4044-65-9	Bitoscanate	500/10,000 [1]
4098-71-9	Isophorone Diisocyanate	100
4104-14-7	Phosacetim	100/10,000 [1]
4170-30-3	Crotonaldehyde, [2-Butena]	1,000
4301-50-2	Fluenetil	100/10,000 [1]
4418-66-0	Phenol, 2,2'-Thiobis(4-Chloro-6- Methyl)	100/10,000 [1]
5344-82-1	Thiourea, (2-Chlorophenyl)-	100/10,000 [1]
5836-29-3	Coumatetralyl	500/10,000 [1]
6533-73-9	*Thallous Carbonate [Thallium (I) carbonate]*	*100/10,000* [1]
6923-22-4	Monocrotophos	10/10,000 [1]
7446-09-5	Sulfur Dioxide	500
7446-11-9	Sulfur Trioxide [Sulfuric anhydride]	100
7446-18-6	Thallous Sulfate [Thallium (I) sulfate]	100/10,000 [1]

Enclosure A
(continued)

CAS No.	Chemical Name	Threshold Quantity (lb)
7487-94-7	Mercuric Chloride	500/10,000 [1]
7550-45-0	Titanium Tetrachloride	100
7580-67-8	Lithium Hydride	100
7631-89-2	Sodium Arsenate	1,000/10,000 [1]
7637-07-2	Boron Trifluoride [Trifluoroborane]	500
7647-01-0	Hydrogen Chloride [Anhydrous Hydrochloric Acid], (Gas)	500
7664-39-3	Hydrogen Fluoride [Anhydrous Hydrofluoric Acid], (Gas)	100
7664-41-7	Ammonia [2]	500
7664-93-9	Sulfuric Acid [3]	1,000
7697-37-2	Nitric Acid	1,000
7719-12-2	Phosphorus Trichloride	1,000
7723-14-0	Phosphorus	100
7726-95-6	Bromine	500
7778-44-1	Calcium Arsenate	500/10,000 [1]
7782-41-4	Fluorine	500
7782-50-5	Chlorine	100
7783-00-8	Selenious Acid	1,000/10,000 [1]
7783-06-4	Hydrogen Sulfide	500
7783-07-5	Hydrogen Selenide	10
7783-60-0	Sulfur Tetrafluoride	100
7783-80-4	Tellurium Hexafluoride	100
7784-34-1	Arsenous Trichloride	500
7784-42-1	Arsine [Arsenic Hydride]	100
7784-46-5	Sodium Arsenite	500/10,000 [1]
7791-12-0	Thallous Chloride [Thallium chloride]	100/10,000 [1]
7803-51-2	Phosphine [Hydrogen Phosphide]	500
8001-35-2	Camphechlor	500/10,000 [1]
10025-73-7	Chromic Chloride	1/10,000 [1]
10025-87-3	Phosphorus Oxychloride [Phosphoryl Chloride]	500
10026-13-8	Phosphorus Pentachloride	500
10028-15-6	Ozone	100
10031-59-1	Thallium Sulfate	100/10,000 [1]
10102-18-8	Sodium Selenite	100/10,000 [1]
10102-20-2	Sodium Tellurite	500/10,000 [1]
10102-43-9	Nitric Oxide [Nitorgen Monoxide (NO)]	100
10102-44-0	Nitrogen Dioxide	100
10124-50-2	Potassium Arsenite	500/10,000 [1]
10210-68-1	Cobalt Carbonyl	10/10,000 [1]
10265-92-6	Methamidophos	100/10,000 [1]
10294-34-5	Boron Trichloride [Trichloroborane]	500
10311-84-9	Dialifor	100/10,000 [1]
12002-03-8	Paris Green [Cupric Acetoarsenite]	500/10,000 [1]
12108-13-3	Manganese, Tricarbonyl Methylcyclopentadienyl	100
13410-01-0	Sodium Selenate	100/10,000 [1]
13450-90-3	Gallium Trichloride	500/10,000 [1]
13463-39-3	Nickel Carbonyl [Nickel Tetracarbonyl]	1
13463-40-6	Iron, Pentacarbonyl-	100
14167-18-1	Salcomine	500/10,000 [1]
15271-41-7	Bicyclo[2.2.1]Heptane-2-Carbonitrile, 5-Chloro-6-((((Methylamino)Carbonyl)Oxy) Imino)-, (1s-(1-alpha,2-beta,4-alpha,5-alpha,6E))-	500/10,000 [1]
16752-77-5	Methomyl	500/10,000 [1]

Enclosure A
(continued)

CAS No.	Chemical Name	Threshold Quantity (lb)
17702-41-9	Decaborane(14)	500/10,000 [1]
17702-57-7	Formparanate	100/10,000 [1]
19287-45-7	Diborane	100
19624-22-7	Pentaborane	500
20830-75-5	Digoxin	10/10,000 [1]
20859-73-8	Aluminum Phosphide	500
21609-90-5	Leptophos	500/10,000 [1]
21908-53-2	Mercuric Oxide	500/10,000 [1]
22224-92-6	Fenamiphos	10/10,000 [1]
23135-22-0	Oxamyl	100/10,000 [1]
23422-53-9	Formetanate Hydrochloride	500/10,000 [1]
26419-73-8	Carbamic Acid, Methyl-, O-(((2,4- Dimethyl-1, 3-Dithiolan-2-YL) Methylene)Amino)-	100/10,000 [1]
26628-22-8	Sodium Azide (Na(N3))	500
27137-85-5	Trichloro(Dichlorophenyl) Silane	500
28347-13-9	Xylylene Dichloride	100/10,000 [1]
28772-56-7	Bromadiolone	100/10,000 [1]
30674-80-7	Methacryloyloxyethyl Isocyanate	100
39196-18-4	Thiofanox	100/10,000 [1]
50782-69-9	Phosphonothioic Acid, Methyl-, S-(2-(Bis(1-Methylethyl)Amino) Ethyl)O-Ethyl Ester	100
53558-25-1	Pyriminil	100/10,000 [1]
58270-08-9	Zinc, Dichloro(4,4-Dimethyl-5 ((((Methylamino) Carbonyl)Oxy)Imino) Pentanenitrile)-, (T-4)-	100/10,000 [1]
62207-76-5	Cobalt, ((2,2'-(1,2-Ethanediylbis (Nitrilomethylidyne)) Bis(6-Fluorophenolato))(2-)-N,N',O,O')-	100/10,000 [1]
MIXTURE	Organorhodium Complex (PMN-82-147)	10/10,000 [1]

1 These extremely hazardous substances are solids. The lesser quantity listed applies only if in powdered form and with a particle size of less than 100 microns; or if handled in solution or in molten form; or the substance has an NFPA rating for reactivity of 2, 3 or 4. Otherwise, a 10,000 pound threshold applies.

2 Appropriate synonyms or mixtures of extremely hazardous substances with the same CAS number are also regulated, e.g., anhydrous ammonia, formalin.

3 Sulfuric acid is a State Regulated Substance only under the following conditions:

   a. If concentrated with greater than 100 pounds of sulfur trioxide or the acid meets the definition of oleum. (The threshold for sulfuric trioxide is 100 pounds). (The threshold for oleum is 10,000 pounds.)

   b. If in a container with flammable hydrocarbons (flash point < 73° F).

4 Hydroquinone is exempt in crystalline form.

Enclosure B

LIST OF CHEMICALS USED DURING 1997 USS CARL VINSON PIA AT PSNS

CAS #	Chemical Name	lb/ Chemical
50-00-0	Formaldehyde	0.2
56-81-5	Glycerol	0.1
57-11-4	Stearic Acid	0.3
57-55-6	1,2-Propylene Glycol	4.3
64-17-5	Ethyl Alcohol	7.5
64-19-7	Acetic Acid	0.1
67-56-1	Methanol	4.5
67-63-0	Isopropyl Alcohol	724.7
67-64-1	Acetone	73.2
69-72-7	Salicylic Acid	0.4
71-36-3	N-Butyl Alcohol	1305.7
71-55-6	1,1,1-Trichloroethane	0.8
74-98-6	Propane	4.1
75-28-5	Isobutane	1.8
78-51-3	Ethanol, 2-Butoxy-, Phospate	25.8
78-83-1	Isobutyl Alcohol	0.4
78-92-2	sec-Butyl Alcohol	104.2
78-93-3	Methyl Ethyl Ketone	8.3
80-05-7	4,4'-Isopropylidenediphenol	0.1
80-15-9	Cumene Hydroperoxide	0.3
81-07-2	Saccharin	0.6
85-68-7	Butyl Benzyl Phthalate	0.1
88-04-0	Chloroxylenol	0.1
90-30-2	1-Naphthaleneamine, N-Phenyl-	0.1
90-72-2	2,4,6 tris Dimethylamino Methyl Phenol	0.1
91-20-3	Naphthalene	0.1
94-13-3	Propylparaben	0.2
95-50-1	1,2-Dichlorobenzene	1.4
95-63-6	1,2,4-Trimethylbenzene	157.6
97-85-8	Isobutyl Isobutyrate	31.2
97-90-5	Methacrylic Acid, Ethylene Ester	0.1
98-55-5	Perfume Terpineol	0.2
99-76-3	Methylparaben	0.4
100-41-4	Ethylbenzene	21.3
101-68-8	Methylenebis(Phenylisocyanate)	5.9
102-71-6	Triethanolamine	54.5
106-11-6	Diglycol Stearate	0.1
107-21-1	Ethylene Glycol	196.3
107-41-5	Hexylene Glycol	233.4
107-88-0	1,3 Butanediol	0.1
108-01-0	Ethanol, 2-Dimethylamino	0.1
108-05-4	Vinyl Acetate	11.7
108-10-1	Methyl Isobutyl Ketone	0.8

CAS #	Chemical Name	lb/ Chemical
108-11-2	Methyl Isobutyl Carbinol	5.2
108-21-4	Isopropyl Acetate	0.3
108-65-6	Propylene Glycol Methyl	1.3
108-88-3	Toluene	84.6
108-90-7	Chlorobenzene	0.5
108-95-2	Phenol	0.1
109-66-0	Pentane	57.8
109-86-4	2-Methoxyethanol	0.2
110-19-0	Iso-Butyl Acetate	1.1
110-30-5	Ethylene-Bis-Stearamid	0.1
110-43-0	Methyl Amyl Ketone	315.5
110-54-3	Hexane	33.8
110-82-7	Cyclohexane	2.0
111-40-0	Diethylene Triamine	0.1
111-41-6	Glycol Ether	2.1
111-76-2	Ethanol, 2-Butoxy	6.4
111-77-3	Ethanol, 2-(2-Methoxyethoxy)-	25.8
112-24-3	Triethyle Amine	45.5
112-57-2	Tetraethylenepentamine	1.3
112-80-1	Oleic Acid	53.8
115-10-6	Methyl Ether	78.5
115-77-5	Pentaerythritol	1.8
122-20-3	Triisopropanolamine	0.5
122-62-3	Dioctyl Sebacate	0.1
123-31-9	Hydroquinone	0.2
123-42-2	Diacetone Alcohol	1.1
123-86-4	Butyl Acetate	4.6
123-94-4	Castor Oil Derivative	3.3
126-99-8	Chloroprene	20.0
128-37-0	p-Cresol, 2,6-Di-Tert-Butyl-	0.1
141-78-6	Ethyl Acetate	0.1
409-21-2	Silicon Carbide	0.3
471-34-1	Carbonic Acid, Calcium Salt (1:1)	0.1
541-05-9	Dimethyl Siloxane	10.0
557-05-1	Zinc Stearate	0.1
613-48-9	n,n-Dialkyltoluidines	0.2
628-63-7	Amyl Acetate	0.1
682-01-9	Tetrapropyl Orthosilicate	0.2
872-50-4	n-Methyl-2-Pyrrolidone	4.2
1185-55-3	Methyltrimethoxysilane	0.1
1302-78-9	Bentonite	288.8
1306-96-4	Sodium Borate	0.1
1309-37-1	Iron Oxide	155.6
1309-64-4	Antimony Trioxide	127.6

Enclosure B
(continued)

CAS #	Chemical Name	lb/ Chemical	CAS #	Chemical Name	lb/ Chemical
1310-58-3	Potassium Hydroxide	50.3	7782-40-3	Diamond	0.2
1310-73-2	Sodium Hydroxide	54.6	7782-42-5	Graphite	0.1
1314-13-2	Zinc Oxide	111.3	7789-23-3	Potassium Fluoride	7.2
1317-33-5	Molybdenum Disulfide	0.6	7789-29-9	Potassium Acid Fluoride	8.1
1317-35-7	Manganese Oxide	25.2	8001-78-3	Castor Oil, Hydrogenated	0.1
1317-65-3	Calcium Carbonate	498.9	8002-43-5	Lecithin	1.3
1317-80-2	Rutile	0.1	8005-02-5	C.I. Solvent Black 7	0.1
1319-77-3	Cresol (Mixed Isomers)	0.3	8006-54-0	Lanolin	0.1
1325-86-6	Solvent Blue 5	0.1	8008-20-6	Kerosene	33.8
1330-20-7	Xylene (Mixed Isomers)	265.4	8009-03-8	Petrolatum	0.7
1332-09-8	Pumice	17388.0	8032-32-4	VM &P Naphtha	126.9
1332-58-7	Clay(Kaolin)	380.9	8042-47-5	White Mineral Oil	0.2
1332-77-0	Potassium Tetraborate	0.9	8050-09-7	Rosin	8.1
1333-86-4	Carbon Black	50.4	8050-31-5	Phenyl-Formaldehyde	0.4
1338-41-6	Sorbitan Monostearate	0.1	8052-10-6	Tall-Oil Rosin	0.1
1344-28-1	Aluminum Oxide (Fibrous Forms)	152.1	8052-41-3	Stoddard Solvent	439.0
2157-45-1	Tetra 2-Methoxyethoxy Silane	0.2	9002-83-9	Chlorotrifluoroethylene	1.3
2426-08-6	Propane, 1-Butoxy-2,3-Epoxy-	103.2	9002-86-2	Polyvinyl Chloride	126.4
2451-62-9	S-Triazine -2,4,6(1h, 3h, 5h)-Trione, 1,3,5-Tris(2,3-Epoxpropyl)-	0.4	9003-01-4	Acrylic Acid, Polymers	115.8
			9003-18-3	Acrylonitrile Butadien	0.4
			9003-20-7	Vinyl Acetate Polymer	600.3
2512-29-0	Yellow Pigment	0.4	9003-31-0	Natural Rubber	1.3
2855-13-2	Isophorone Diamine	0.1	9003-35-4	Phenolic Polymer	0.1
3468-63-1	Orange Dye	0.4	9003-53-6	Polystyrene Resin	1.5
4253-34-3	Methyltriacetoxy Silane	1.9	9004-32-4	Cellulose Gum	0.2
4485-12-5	Stearic Acid, Lithium Salt	0.1	9004-34-6	Cellulose	44.0
5593-70-4	Tetrabutyl Titanate	0.2	9004-65-3	Hydroxypropyl Methylcellulous	0.2
5989-27-5	d-Limonene	64.4	9004-70-0	Cellulose Nitrate	0.1
7085-85-0	Ethyl Cyanoacrylate	1.2	9004-96-0	Glycols, Polyethylene, Monooleate	3.3
7429-90-5	Aluminum	446.4			
7439-96-5	Manganese	5.1	9010-98-4	1,3-Butadiene, 2-Chloro-, Polymers	10.7
7440-02-0	Nickel	4.1			
7440-21-3	Silicon	143.7	9011-14-7	Polymethylmethacrylate	0.2
7440-42-8	Boron	0.7	9016-45-9	Agral 90	63.1
7440-48-4	Cobalt	23.8	9016-87-9	Polymeric Diphenylmethane Diisocyanate	5.9
7440-50-8	Copper	1.5	9022-96-2	Butyl Polytitanate	0.1
7440-66-6	Zinc	0.1			
7446-26-6	Zinc Pyrophosphate	0.1	9038-95-3	Glycols, Polyethylenepolypropylene, Monobutyl Ether	0.2
7601-54-9	Sodium Phosphate, Tribasic	7.0			
7631-86-9	Silica, Amorphous	36.2	10034-77-2	di Calcium Silicate	0.8
7632-00-0	Sodium Nitrite	2.8	10043-01-3	Aluminum Sulfate	8.5
7646-85-7	Zinc Chloride	0.1	10043-35-3	Boric Acid	10.1
7681-52-9	Hypochlorous acid, sodium salt	20.5	10377-48-7	Lithium Stearate	1.4
7722-84-1	Hydrogen Peroxide	0.2	11128-29-3	Potassium Pentaborate	0.9
7727-43-7	Barium Sulfate	0.9	12001-26-2	Mica	427.2
7732-18-5	Water	1555.4	12068-35-8	Tetra Calcium Alumino	0.8
7758-87-4	Calcium Phosphate	0.1	12168-85-3	tri Calcium Silicate, Cement Portland	0.8
7775-11-3	Sodium Chromate	0.4			
7778-18-9	Calcium Sulfate	0.8	12227-89-3	Inorganic Pigment	3.1

Enclosure B
(continued)

CAS #	Chemical Name	lb/ Chemical
12228-71-6	Potassium Fluoride	25.2
13463-67-7	Titanium Dioxide	1148.0
13530-50-2	Aluminum Phosphate	0.1
14801-96-6	Mikro Talc	96.5
14807-96-6	Talc	2187.9
14808-60-7	Silica, Crystalline	88.6
17689-77-9	Ethyltriacetoxysilane	1.9
21645-51-2	Aluminum Hydroxide	44.0
22914-58-5	Zinc Molybdate	15.4
25065-38-6	Epoxy Resin	119.3
25068-38-6	Araldite Gy 250	1336.4
25068-38-8	Epoxy Polymer	653.9
25085-50-1	Phenolic Resin	4.7
25265-77-4	Propionic Acid, 2-Methyl-, Monoester with 2,2,4-Trimethyl-1,30pentanediol	4.1
25322-68-3	Polyethylene Glycol	0.2
25359-84-6	Phenol-Alpha-Pinene	0.8
25551-13-7	Trimethyl Benzene	27.3
25767-47-9	Styrene Acrylate Resin	0.3
25852-47-5	Polyglycol Dimethacryl	5.1
26027-38-3	Glycols, Polyethylene, Mono(p-Nonylphenyl) Ether	1.2
26299-47-8	Acrylic Resin	10.8
26761-45-5	Epoxy Ester Resin	1.8
27306-78-1	Surfactant	0.4
28064-14-4	Epoxy Phenol Novolac Resin	0.6
34590-94-8	Dipropylene Glycol, Monomethyl Ether	126.5
37244-96-5	Sodium Pot Aluminum Silicate	198.3
37338-62-8	Alkylated Diphenylamin	0.1
38294-69-8	Amine-Adduct Epoxy Hardener	2551.8
39382-25-7	Bis-Phenol A Fumarate	0.1
42131-42-0	Anti-Stat	0.4
51274-00-1	C.I. Pigment Yellow 42	20.8
54351-63-2	Organophilic Clay	0.1
57455-37-5	C.I. Pigment Blue 29	1.4
60164-51-4	Perfluoroalkylether	0.2
60322-47-6	Methacrylate Copolymer	0.1
60676-86-0	Silica, Crystalline-Fused	1.0
61790-37-2	Tallow Acid	1.2
61790-53-2	Amorphous Silica	267.2
61790-67-8	Tea Tallowate	2.4
61790-81-6	Peg-75 Lanolin	0.2
63148-52-7	Silicone	391.7
63148-62-9	Dow coming 360 fluid	11.9
63231-67-4	Silica Gel	0.9
63393-93-1	Fatty Acid Ester	0.2
63449-39-8	Chlorinated Parafins	596.4

CAS #	Chemical Name	lb/ Chemical
64741-65-7	Heavy Alkylated Naphtha	12.2
64741-89-5	Light Paraffinic Petroleum Distillates	0.2
64741-92-0	Mineral Spirit	53.9
64741-96-4	Petroleum Distillates, Solvent-Refined (Mild) Heavy Naphthenic	3.6
64742-46-7	Petroleum Distillates, Hydrotreated Middle	336.0
64742-47-8	Hydrotreated Kerosene	6.2
64742-48-9	VM&P Naphtha	9.5
64742-52-5	Petroleum Distillates, Hydrotreated (Mild) Heavy Naphthenic	0.5
64742-54-7	Petroleum Distillates, Hydrotreated (Mild) Heavy Paraffinic	8.8
64742-65-0	Solvent Dewaxed Heavy Paraffinic	67.0
64742-88-7	Mineral Spirits	512.5
64742-89-8	VM&P Naphtha High Flash	341.5
64742-95-6	Petroleum Naphtha, High Flash	3249.0
64742-96-6	Hydrocarbon Solvent	0.1
65996-69-2	Mineral Fiber	276.0
65997-13-9	Rosin Ester	0.8
65997-15-1	Silicate, Portland Cement	301.5
65997-17-3	Fibrous Glass	72.0
66402-68-4	Aluminum Silicate	147.8
66410-23-1	Polyamide	10.1
67701-25-1	DEA-Tallowate	0.2
68037-01-4	Polyalphaolefins	28.0
68082-29-1	Polyamide Resin	321.7
68083-14-7	Methylphenylsiloxane	3.6
68131-74-8	Coal Fly Ash	276.0
68400-67-9	Synthetic Urethane Rub	0.3
68412-37-3	Ethyl Polysilicate	0.3
68439-93-0	Vegetable Oil	8.1
68441-83-8	Resin	0.1
68443-08-3	Amido Amine Resin	46.1
68476-85-7	Liquified Petroleum Gas	19.0
68476-96-0	Slag	50.4
68478-07-9	Hydrocarbon Resin	427.2
68515-03-7	Alkyd Resin	3.9
68603-42-9	Coconut Oil Acid Diethanolamine	0.2
68609-97-2	c12-c14 Aliphatic Glycidyl Ethers	25.2
68611-24-5	Magnesium Resinate	1.2
68855-54-9	Silica, Amorphous-Diatomaceous Earth	30.0
68920-70-7	Chlorinated Paraffin	17.6
68937-90-6	Carboxylic Acid	44.0
69430-24-6	Dimethyl Cyclosiloxane	0.7
70131-67-8	Polydimethylsiloxane	12.6

Enclosure B
(continued)

CAS #	Chemical Name	lb/ Chemical
71011-25-1	Organophilic Clay	9.8
71011-27-3	Organophilic Clay	44.0
71892-73-4	Thixoltrol	0.1
79070-11-4	Telomers Of Tetrafluor	0.1
88888-88-8	*Trade Secret*	508.2
99999-99-9	Not Listed	1362.3
112926-00-8	Silica, Amorphous, Precipitated And Gel	26.4
112945-52-5	Silica	0.1

Enclosure C

EXAMPLE OF NAVY HAZARDOUS MATERIAL CONTROL AND MANAGEMENT PRACTICES AT PSNS

The primary objective of the Navy's Hazardous Material Control and Management (HMC&M) program is to establish uniform requirements for all Navy activities for the life-cycle control of hazardous material. These requirements are promulgated in OPNAVINST 4110.2. All naval activities have established local procedures implementing the requirements of OPNAVINST 4110.2. As an example of a naval activity's implementation of the HMC&M program, Puget Sound Naval Shipyard's management of hazardous material is described as follows:

PSNS has consolidated hazardous material and hazardous waste programs into a single organization (Code 910HZ) focused on integrated hazardous material management. A centralized Hazardous Material Control Center (HMCC) was established to manage Shipyard hazardous material. A delivery and pick-up system was established with a "Just-In-Time" concept of delivering needed hazardous materials directly to worksites. The goal of the delivery and pick-up system is to improve services to the job site by reducing the risks associated with handling and storage of hazardous material and waste. Consequently, the need for widespread storage of bulk hazardous material has been significantly reduced. Centralized control also enables accurate reporting of environmental, safety and health data.

A team of trained Code 910HZ hazardous material handlers deliver the hazardous materials throughout PSNS, insuring material is properly labeled, segregated and stored. This team inspects flammable material storage lockers on a periodic basis to insure continued compliance with the applicable requirements for safe storage of hazardous materials.

A Reuse Program has also been established to manage excess hazardous materials. Hazardous material that is no longer needed for a particular project is turned in to the Shipyard Reuse Store. Additionally, hazardous waste handlers check materials turned in for disposal and divert all potentially reusable hazardous materials to the Reuse Store. All new hazardous material requests are first checked against the Reuse Store inventory. The Reuse Store has reduced hazardous material orders, material repurchase costs, and hazardous waste disposal costs.

During major availabilities such as a CVN PIA, PSNS assigns an Environmental Manager to oversee hazardous material and hazardous waste operations specifically for the project. A pier-side hazardous material storage area is established for the project to provide easy access to required materials. The project's hazardous material storage consists of one or two 8' x 12' x 6' self contained flammable material storage lockers. Hazardous material needed for the project is delivered from the Shipyard HMCC to the project locker on an "as needed" basis. Hazardous materials are used for the tasks at hand and any excess is returned to the storage locker to be used by the next shift. All hazardous material used for the project is closely controlled by the project's Environmental Manager. Personnel who are responsible for operation of flammable material storage lockers undergo extensive training and have considerable expertise in safe management of hazardous substances.

A worker is required to order only the quantity of a substance required for a work evolution, which minimizes the quantity of hazardous substances staged in flammable material storage lockers. In addition, all excess material no longer needed by the project is moved to a centralized location separate from the hazardous material storage area. Here the material is consolidated, packaged, and labeled.

Material designated hazardous waste is promptly moved to a "90-Day" hazardous waste accumulation area for further consolidation or designation, or directly to the Shipyard Treatment, Storage, and Disposal Facility (TSDF). No hazardous waste is stored shipboard or pier-side during the availability.

Enclosure D

ANALYSIS OF FLAMMABLE SUBSTANCES

SUBSTANCE	CAS #	WEIGHT (kg)	HEAT OF COMBUSTION (kJ/kg)	DISTANCE TO OVERPRESSURE OF 1 psi (meters)
Isobutane	75-28-5	0.8	45,576	16
Propane	74-98-6	10.5	46,333	37
Pentane	109-66-0	26.3	44,697	50
Dimethyl Ether	115-10-6	35.7	28,835	48
All Flammable Substances Combined [1]	N/A	73.3	37,216	66

1 - The total represents the total weight of all substances and a calculated heat of combustion for the mixture. The heat of combustion of a mixture is the sum of each constituent's weight percentage (in the mixture) times its heat of combustion.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR PSNS - RURAL LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/ m^3)	RELEASE RATE (g/s)	CONCENTRATION AT MOI[2] (mg/ m^3)	FRACTION OF LEVEL OF CONCERN FOR MOI[2]
FORMALDEHYDE	12	0.15	0.22	0.02
VINYL ACETATE	260	9.49	13.52	0.05
PHENOL	192	0.07	0.10	5.3E-4
HYDROQUINONE	5	0.08	0.12	0.02
N-BUTYL ALCOHOL	431	978.06	1393.02	3.23
ISOPROPYL ALCOHOL	980	535.02	762.02	0.78
XYLENE	435	225.35	320.95	0.74
NAPHTHA	457	7069.73	10069.22	22.03
		ESTIMATED CUMULATIVE IMPACT		26.87
				MOI

1. Level of Concern is defined in Section 4.1.1 of this appendix.
2. MOI is the maximally exposed off-site individual, representing an individual living at the naval base boundary.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR PSNS - RURAL LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	DISTANCE TO MOI (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	526
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	526
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	526
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	526
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	526
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	526
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	526
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	526

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR PSNS - URBAN LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/ m³)	RELEASE RATE (g/s)	CONCEN-TRATION AT WORKER (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR WORKER	CONCEN-TRATION AT NPA[2] (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR NPA[2]	CONCEN-TRATION AT MOI[3] (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR MOI[3]
FORMALDEHYDE	12	0.15	0.37	0.03	0.12	9.6E-3	0.02	1.3E-3
VINYL ACETATE	260	9.49	23.53	0.09	7.26	0.03	0.95	3.6E-3
PHENOL	192	0.07	0.18	9.2E-4	0.05	2.8E-4	7.1E-3	3.7E-5
HYDROQUINONE	5	0.08	0.20	0.04	0.06	0.01	8.1E-3	1.6E-3
N-BUTYL ALCOHOL	431	978.06	2424.44	5.63	747.87	1.74	97.46	0.23
ISOPROPYL ALCOHOL	980	535.02	1326.23	1.35	409.11	0.42	53.32	0.05
XYLENE	435	225.35	558.59	1.28	172.31	0.40	22.46	0.05
NAPHTHA	457	7069.73	17524.63	38.35	5405.86	11.83	704.50	1.54
ESTIMATED CUMULATIVE IMPACT				46.77		14.43		1.88
				WORKER		**NPA**		**MOI**

1. Level of Concern is defined in Section 4.1.1 of this appendix.
2. NPA is the nearest public access individual, representing military personnel, civilian employees or their family members, including those that reside on the base.
3. MOI is the maximally exposed off-site individual, representing an individual living at the naval base boundary.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR PSNS - URBAN LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	DISTANCE TO WORKER (m)	DISTANCE TO NPA (m)	DISTANCE TO MOI (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	100	182	526
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	100	182	526
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	100	182	526
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	100	182	526
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	100	182	526
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	100	182	526
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	100	182	526
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	100	182	526

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR PHNSY - RURAL LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/ m^3)	RELEASE RATE (g/s)	CONCENTRATION AT MOI[2] (mg/ m^3)	FRACTION OF LEVEL OF CONCERN FOR MOI[2]
FORMALDEHYDE	12	0.15	0.08	6.4E-3
VINYL ACETATE	260	9.49	4.81	0.02
PHENOL	192	0.07	0.04	1.9E-4
HYDROQUINONE	5	0.08	0.04	8.3E-3
N-BUTYL ALCOHOL	431	978.06	496.05	1.15
ISOPROPYL ALCOHOL	980	535.02	271.35	0.28
XYLENE	435	225.35	114.29	0.26
NAPHTHA	457	7069.73	3585.59	7.85
		ESTIMATED CUMULATIVE IMPACT		9.57
				MOI

1. Level of Concern is defined in Section 4.1.1 of this appendix.
2. MOI is the maximally exposed off-site individual, representing an individual living at the naval base boundary.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR PHNSY - RURAL LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	DISTANCE TO MOI (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	936
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	936
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	936
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	936
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	936
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	936
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	936
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	936

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR PHNSY - URBAN LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/m^3)	RELEASE RATE (g/s)	CONCENTRATION AT WORKER (mg/m^3)	FRACTION OF LEVEL OF CONCERN FOR WORKER	CONCENTRATION AT NPA[2] (mg/m^3)	FRACTION OF LEVEL OF CONCERN FOR NPA[2]	CONCENTRATION AT MOI[3] (mg/m^3)	FRACTION OF LEVEL OF CONCERN FOR MOI[3]
FORMALDEHYDE	12	0.15	0.37	0.03	0.03	2.7E-3	5.21E-03	4.3E-4
VINYL ACETATE	260	9.49	23.53	0.09	2.01	7.7E-3	0.33	1.3E-3
PHENOL	192	0.07	0.18	9.2E-4	0.02	7.9E-5	2.5E-3	1.3E-5
HYDROQUINONE	5	0.08	0.20	0.04	0.02	3.5E-3	2.8E-3	5.6E-4
N-BUTYL ALCOHOL	431	978.06	2424.44	5.63	207.59	0.48	33.72	0.08
ISOPROPYL ALCOHOL	980	535.02	1326.23	1.35	113.55	0.12	18.45	0.02
XYLENE	435	225.35	558.59	1.28	47.83	0.11	7.77	0.02
NAPHTHA	457	7069.73	17524.63	38.35	1500.49	3.28	243.74	0.53
ESTIMATED CUMULATIVE IMPACT				46.77		4.00		0.65
				WORKER		NPA		MOI

1. Level of Concern is defined in Section 4.1.1 of this appendix.
2. NPA is the nearest public access individual, representing military personnel, civilian employees or their family members, including those that reside on the base.
3. MOI is the maximally exposed off-site individual, representing an individual living at the naval base boundary.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR PHNSY - URBAN LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	DISTANCE TO WORKER (m)	DISTANCE TO NPA (m)	DISTANCE TO MOI (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	100	353	936
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	100	353	936
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	100	353	936
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	100	353	936
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	100	353	936
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	100	353	936
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	100	353	936
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	100	353	936

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR NASNI - RURAL LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/ m^3)	RELEASE RATE (g/s)	CONCENTRATION AT MOI[2] (mg/ m^3)	FRACTION OF LEVEL OF CONCERN FOR MOI[2]
FORMALDEHYDE	12	0.15	0.05	4.2E-3
VINYL ACETATE	260	9.49	3.20	0.01
PHENOL	192	0.07	0.02	1.3E-4
HYDROQUINONE	5	0.08	0.03	5.5E-3
N-BUTYL ALCOHOL	431	978.06	329.37	0.76
ISOPROPYL ALCOHOL	980	535.02	180.17	0.18
XYLENE	435	225.35	75.89	0.17
NAPHTHA	457	7069.73	2380.77	5.21
		ESTIMATED CUMULATIVE IMPACT		6.35
				MOI

1. Level of Concern is defined in Section 4.1.1 of this appendix.
2. MOI is the maximally exposed off-site individual, representing an individual living at the naval base boundary.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR NASNI - RURAL LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	DISTANCE TO MOI (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	1189
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	1189
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	1189
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	1189
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	1189
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	1189
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	1189
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	1189

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR NASNI - URBAN LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/ m³)	RELEASE RATE (g/s)	CONCEN-TRATION AT WORKER (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR WORKER	CONCEN-TRATION AT NPA[2] (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR NPA[2]	CONCEN-TRATION AT MOI[3] (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR MOI[3]
FORMALDEHYDE	12	0.15	0.37	0.03	0.16	0.01	3.4E-3	2.8E-4
VINYL ACETATE	260	9.49	23.53	0.09	10.32	0.04	0.21	8.2E-4
PHENOL	192	0.07	0.18	9.2E-4	0.08	4.0E-4	1.6E-3	8.4E-6
HYDROQUINONE	5	0.08	0.20	0.04	0.09	0.02	1.8E-3	3.7E-4
N-BUTYL ALCOHOL	431	978.06	2424.44	5.63	1063.87	2.47	22.01	0.05
ISOPROPYL ALCOHOL	980	535.02	1326.23	1.35	581.96	0.59	12.04	0.01
XYLENE	435	225.35	558.59	1.28	245.12	0.56	5.07	0.01
NAPHTHA	457	7069.73	17524.63	38.35	7689.96	16.83	159.10	0.35
ESTIMATED CUMULATIVE IMPACT				46.77		20.52		0.42
				WORKER		**NPA**		**MOI**

1. Level of Concern is defined in Section 4.1.1 of this appendix.
2. NPA is the nearest public access individual, representing military personnel, civilian employees or their family members, including those that reside on the base.
3. MOI is the maximally exposed off-site individual, representing an individual living at the naval base boundary.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR NASNI - URBAN LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	DISTANCE TO WORKER (m)	DISTANCE TO NPA (m)	DISTANCE TO MOI (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	100	152	1189
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	100	152	1189
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	100	152	1189
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	100	152	1189
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	100	152	1189
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	100	152	1189
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	100	152	1189
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	100	152	1189

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR EVERETT[3] - RURAL LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/m^3)	RELEASE RATE (g/s)	CONCENTRATION AT MOI[2] (mg/m^3)	FRACTION OF LEVEL OF CONCERN FOR MOI[2]
FORMALDEHYDE	12	0.15	0.41	0.03
VINYL ACETATE	260	9.49	25.76	0.10
PHENOL	192	0.07	0.19	1.0E-3
HYDROQUINONE	5	0.08	0.22	0.04
N-BUTYL ALCOHOL	431	978.06	2654.36	6.16
ISOPROPYL ALCOHOL	980	535.02	1452.00	1.48
XYLENE	435	225.35	611.57	1.41
NAPHTHA	457	7069.73	19186.50	41.98
		ESTIMATED CUMULATIVE IMPACT		51.21
				MOI

1. Level of Concern is defined in Section 4.1.1 of this appendix.
2. MOI is the maximally exposed off-site individual, representing an individual living at the naval base boundary.
3. PIA type maintenance is not expected to occur at NAVSTA Everett. Therefore, the quantities of these substances on hand are expected to be significantly less, thus conservatively overstating the level of impact.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR EVERETT - RURAL LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	DISTANCE TO MOI (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	372
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	372
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	372
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	372
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	372
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	372
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	372
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	372

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR EVERETT[4] - URBAN LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/ m³)	RELEASE RATE (g/s)	CONCEN-TRATION AT WORKER (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR WORKER	CONCEN-TRATION AT NPA[2] (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR NPA[2]	CONCEN-TRATION AT MOI[3] (mg/ m³)	FRACTION OF LEVEL OF CONCERN FOR MOI[3]
FORMALDEHYDE	12	0.15	0.37	0.03	0.05	4.5E-3	0.03	2.4E-3
VINYL ACETATE	260	9.49	23.53	0.09	3.37	0.01	1.82	7.0E-3
PHENOL	192	0.07	0.18	9.2E-4	0.03	1.3E-4	0.01	7.1E-5
HYDROQUINONE	5	0.08	0.20	0.04	0.03	5.8E-3	0.02	3.1E-3
N-BUTYL ALCOHOL	431	978.06	2424.44	5.63	347.56	0.81	187.80	0.44
ISOPROPYL ALCOHOL	980	535.02	1326.23	1.35	190.12	0.19	102.73	0.10
XYLENE	435	225.35	558.59	1.28	80.08	0.18	43.27	0.10
NAPHTHA	457	7069.73	17524.63	38.35	2512.25	5.50	1357.46	2.97
			ESTIMATED CUMULATIVE IMPACT	46.77		6.71		3.62
				WORKER		**NPA**		**MOI**

1. Level of Concern is defined in Section 4.1.1 of this appendix.
2. NPA is the nearest public access individual, representing military personnel, civilian employees or their family members, including those that reside on the base.
3. MOI is the maximally exposed off-site individual, representing an individual living at the naval base boundary.
4. PIA type maintenance is not expected to occur at NAVSTA Everett. Therefore, the quantities of these substances on hand are expected to be significantly less, thus conservatively overstating the level of impact.

Enclosure D
(continued)

ANALYSIS OF TOXIC SUBSTANCES FOR EVERETT - URBAN LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	DISTANCE TO WORKER (m)	DISTANCE TO NPA (m)	DISTANCE TO MOI (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	100	270	372
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	100	270	372
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	100	270	372
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	100	270	372
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	100	270	372
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	100	270	372
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	100	270	372
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	100	270	372

Enclosure D
(continued)

DETERMINATION OF LONGEST DISTANCE TO LEVEL OF CONCERN; RURAL LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/ m³)	DISTANCE TO LEVEL OF CONCERN (m)	RELEASE RATE (g/s)	CONCENTRATION AT MINIMUM CALCULABLE DISTANCE (mg/ m³)
FORMALDEHYDE	12	<100	0.15	5.19
VINYL ACETATE	260	112	9.49	325.91
PHENOL	192	<100	0.07	2.45
HYDROQUINONE	5	<100	0.08	2.80
N-BUTYL ALCOHOL	431	1015	978.06	33586.37
ISOPROPYL ALCOHOL	980	459	535.02	18372.58
XYLENE	435	446	225.35	7738.33
NAPHTHA	457	3494	7069.73	242772.68

1. Level of Concern is defined in Section 4.1.1 of this appendix.

Enclosure D
(continued)

DETERMINATION OF LONGEST DISTANCE TO LEVEL OF CONCERN; RURAL LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	MINIMUM CALCULABLE DISTANCE (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	100
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	100
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	100
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	100
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	100
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	100
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	100
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	100

Enclosure D
(continued)

DETERMINATION OF LONGEST DISTANCE TO LEVEL OF CONCERN; URBAN LANDSCAPE

SUBSTANCE	LEVEL OF CONCERN[1] (mg/ m^3)	DISTANCE TO LEVEL OF CONCERN (m)	RELEASE RATE (g/s)	CONCENTRATION AT MINIMUM CALCULABLE DISTANCE (mg/ m^3)
FORMALDEHYDE	12	<100	0.15	0.37
VINYL ACETATE	260	<100	9.49	23.53
PHENOL	192	<100	0.07	0.18
HYDROQUINONE	5	<100	0.08	0.20
N-BUTYL ALCOHOL	431	242	978.06	2424.44
ISOPROPYL ALCOHOL	980	117	535.02	1326.23
XYLENE	435	114	225.35	558.59
NAPHTHA	457	664	7069.73	17524.63

1. Level of Concern is defined in Section 4.1.1 of this appendix.

Enclosure D
(continued)

DETERMINATION OF LONGEST DISTANCE TO LEVEL OF CONCERN; URBAN LANDSCAPE (Continued)

SUBSTANCE	TOTAL WEIGHT (lb)	WIND SPEED (m/s)	MOLECULAR WEIGHT (g/mole)	VAPOR PRESSURE (mm Hg)	BOILING POINT (C)	DENSITY (lb/ft^3)	MINIMUM CALCULABLE DISTANCE (m)
FORMALDEHYDE	0.2	1.5	N/A	N/A	N/A	N/A	100
VINYL ACETATE	11.7	1.5	86.1	760.00	73	58.3	100
PHENOL	0.1	1.5	94.1	760.00	90.2	66.9	100
HYDROQUINONE	0.2	1.5	110.1	760.00	285	84.8	100
N-BUTYL ALCOHOL	1305.7	1.5	74.1	760.00	117.4	50.6	100
ISOPROPYL ALCOHOL	724.7	1.5	60.1	760.00	82.5	49	100
XYLENE	265.4	1.5	106.2	760.00	138.5	53.9	100
NAPHTHA	5200.7	1.5	79	760.00	30	37.5	100

APPENDIX K

AIR QUALITY CONFORMITY ANALYSIS

APPENDIX K

FINAL CLEAN AIR ACT CONFORMITY ANALYSIS

DEVELOPING HOME PORT FACILITIES FOR THREE NIMITZ-CLASS AIRCRAFT CARRIERS IN SUPPORT OF THE U.S. PACIFIC FLEET

SAN DIEGO, CALIFORNIA AND EVERETT, WASHINGTON

1.0 INTRODUCTION

This appendix includes a discussion of the Clean Air Act general conformity requirements promulgated by the U.S. Environmental Protection Agency (EPA) and how they relate to the actions associated with the homeporting of three NIMITZ-Class aircraft carriers in support of the U.S. Pacific Fleet, as proposed by the Department of Navy (DON) in the *Draft Environmental Statement for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet*. Included in this appendix are (1) a final record of non-applicability (RONA) for the project actions at San Diego, California (NASNI) and (2) a final RONA for the project actions at NAVSTA Everett.

2.0 CLEAN AIR ACT CONFORMITY REQUIREMENTS

Introduction

Section 176(c) of the Clean Air Act requires that federal agency actions be consistent with the Clean Air Act and with any approved air quality management plan (state implementation plan [SIP]). EPA adopted Clean Air Act conformity requirements in two stages: one rule for regional transportation plans, highway projects, and transit projects; and a second rule for other federal agency actions.

The conformity rule for highway and mass transit plans and projects was promulgated in the November 24, 1993 *Federal Register* (58 FR 62188-62216). The transportation conformity rule (40 CFR Part 93 Subpart A; duplicated in 40 CFR Part 51 Subpart T) applies to transportation plans and transportation projects that require action by the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA) under Title 23 U.S.C. or the Federal Transit Act. The transportation conformity rule defines a "transportation project" as a highway project or mass transit project. Federal agency actions affecting airports, harbors, or freight rail facilities would normally be subject to the general conformity rule, not the transportation conformity rule.

The conformity rule for general federal actions was promulgated in the November 30, 1993 *Federal Register* (58 FR 63214-63259), and became effective on January 31, 1994. The Navy's proposed homeporting action is subject to the general conformity rule (40 CFR Part 93 Subpart B; duplicated in 40 CFR Part 51 Subpart W).

Purpose of the General Conformity Rule

The EPA general conformity rule requires federal agencies to analyze proposed actions according to standardized procedures and to provide a public review and comment process. The conformity determination process is intended to demonstrate that the proposed federal action:

- Will not cause or contribute to new violations of federal air quality standards;
- Will not increase the frequency or severity of existing violations of federal air quality standards; and
- Will not delay the timely attainment of federal air quality standards.

Applicability of the General Conformity Rule

The EPA general conformity rule applies to general federal actions affecting nonattainment areas and to designated maintenance areas (attainment areas that have been reclassified from a previous nonattainment status and which are required to prepare an air quality maintenance plan). Conformity requirements apply only to nonattainment and maintenance pollutants. Emissions of attainment pollutants are exempt from conformity analyses.

Analyses required by the general conformity rule focus on the net increase in emissions compared to ongoing historical conditions. Existing SIPs are presumed to have accounted for routine, ongoing federal agency activities. Conformity analyses are further limited to those direct and indirect emissions over which the federal agency has responsibility and control. General conformity analyses are not required to analyze emission sources that are beyond the responsibility and control of the federal agency. Conformity determinations are not required to address emissions that are not reasonably foreseeable or reasonably quantifiable.

Highway or mass transit projects that require FHWA or FTA funding or approval will be subject to transportation conformity rule requirements rather than the EPA general conformity rule requirements. Five additional categories of actions and projects also are excluded from the general conformity rule requirements (40 CFR 93.153[d]; 40 CFR 51.853[d]):

- Stationary sources requiring new source review (NSR) or prevention of significant deterioration (PSD) permits;
- Direct emissions from remedial actions at Superfund (CERCLA) sites when the substantive requirements of NSR/PSD programs are met or when the action is otherwise exempted under provisions of CERCLA;
- Initial and continuing actions in response to emergencies or disasters;
- Alterations and additions to existing structures as specifically required by applicable environmental legislation or regulations; and
- Various special studies and research investigation actions.

In addition, conformity determinations are not required when the annual direct and indirect emissions from the action will be less than the applicable "de minimis" thresholds (40 CFR 93.153[c][1]; 40 CFR 51.853[c][1]). Applicable de mimimis levels vary by pollutant and the severity of nonattainment conditions (40 CFR 93.153[b]; 40 CFR 51.853[b]). The de minimis thresholds in carbon monoxide, sulfur dioxide, or nitrogen dioxide nonattainment areas are 100 tons per year of the relevant pollutant. The de minimis threshold in lead nonattainment areas is 25 tons per year.

The de minimis threshold in ozone nonattainment areas applies separately to both organic compound and nitrogen oxide emissions. The de minimis level varies according to severity of nonattainment: 100 tons per year in marginal or moderate nonattainment areas, 50 tons per year in serious nonattainment areas, 25 tons per year in severe nonattainment areas, and 10 tons per year in extreme nonattainment areas.

The de minimis threshold in PM_{10} nonattainment areas applies separately to PM_{10} precursors as well as to directly emitted PM_{10}. The de minimis level is 100 tons per year in moderate nonattainment areas and 70 tons per year in severe nonattainment areas.

The EPA conformity rule (40 CFR 93.153[c][2]; 40 CFR 51.853[c][2]) identifies several categories of actions that are presumed to result in no net emissions increase or in an emissions increase that will clearly be less than any applicable de minimis level. These types of activities are primarily routine administrative, planning, financial, property disposal, or property maintenance actions.

Regardless of the applicable de minimis level, conformity assessments are required for non-exempt "regionally significant" actions: direct and indirect emissions exceed 10 percent of the applicable SIP emissions inventory, regardless of numerical value.

The proposed homeporting alternatives would occur in four locations: (1) San Diego, California (NASNI); (2) Everett, Washington (NAVSTA Everett); (3) Bremerton, Washington; and (4) Honolulu, Hawaii. Since the latter two locations are in attainment of all national ambient air quality standards (NAAQS), only the actions proposed for NASNI and NAVSTA Everett are considered in this conformity analysis. Emission estimates documented in subsequent sections of this appendix demonstrate that all project alternatives at NASNI and NAVSTA Everett would have total conformity-related emissions that are below the relevant de minimis thresholds. These alternatives would qualify for a RONA.

The proposed actions must demonstrate conformity for the following time periods: (1) the Clean Air Act mandated attainment year, or if applicable, the farthest year for which emissions are projected in a maintenance plan, (2) the year when the total annual emissions from the proposed action are the greatest, and (3) any year for which the applicable SIP specifies an annual emissions budget. For actions that would occur at NASNI, the appropriate years to consider in the analysis would be (1) the 1999 attainment year for serious ozone areas (volatile organic compounds and nitrogen oxide emissions), (2) any year beyond 1995 attainment deadline for moderate carbon monoxide areas, and (3) the year with the maximum annual emissions. For actions that would occur at NAVSTA Everett, the appropriate years to consider in the analysis would be (1) the farthest year for which emissions are projected in the maintenance plan, which is 2006 for ozone and carbon monoxide and (2) the year with the maximum annual emissions.

Responsibility for Conformity Determinations

The federal agency undertaking the action is responsible for preparing and issuing the conformity determination under the EPA conformity rules. Other federal, state, and local agencies have review and comment responsibility, but no agency has approval/denial authority over the conformity determination.

Options for Demonstrating Conformity

Two types of technical analyses can be used to demonstrate clean air act conformity:

- Dispersion modeling demonstrations for primary (i.e., directly emitted) pollutants to show that there will be no violations of federal ambient air quality standards; or
- Emissions analyses that demonstrate that there will be no net emissions increase and that emissions will not interfere with the timely attainment and maintenance of federal ambient air quality standards.

Dispersion modeling demonstrations of conformity are not allowed for ozone nonattainment areas, and will seldom be feasible for other secondary pollutants (nitrogen dioxide and particulate matter). In addition, modeling may not be possible for some types of emission sources due to the lack of appropriate dispersion models. In general, dispersion modeling is most useful for carbon monoxide, lead, and sulfur dioxide nonattainment areas. Dispersion modeling may be useful in some PM_{10} nonattainment areas if secondary PM_{10} is not a significant contributor to nonattainment conditions.

If dispersion modeling is not used for the conformity demonstration, then the conformity demonstration requires either consistency with emission forecasts in SIP documents or identification of concurrent or prior emission reductions that will compensate for emission increases associated with a proposed action.

If EPA has not yet approved a SIP document submitted pursuant to the Clean Air Act Amendments of 1990, there are two basic options for demonstrating conformity.

- Conformity will be demonstrated if direct and indirect emissions from the action are fully offset through compensating emission reductions implemented through a federally enforceable mechanism (40 CFR 93.158[a][2]; 40 CFR 51.858[a][2]).
- Alternatively, conformity can be demonstrated by showing that total direct and indirect emissions with the federal action do not exceed estimated future baseline scenario emissions. Future baseline scenario emissions are total direct and indirect emissions that would occur in future years if baseline (1990 or the nonattainment designation year) emission source activity levels remain constant in the geographic area affected by the federal action. The future baseline scenario represents a "no action" scenario projected to the maximum emissions year for the proposed action, to the attainment year mandated by the Clean Air Act, and to any other "milestone" years identified in the existing SIP (40 CFR 93.158[a][5][iv][A]; 40 CFR 51.858[a][5][iv][A]).

If EPA has approved SIP revisions pursuant to the 1990 Clean Air Act Amendments, any one of several options can be used for demonstrating conformity.

- Conformity is presumed if direct and indirect emissions from the activity are specifically identified and accounted for in the attainment or maintenance demonstration of a SIP approved after 1990 (40 CFR 93.158[a][1]; 40 CFR 51.858[a][1]).

- Conformity will be demonstrated if direct and indirect emissions from the action are fully offset through compensating emission reductions implemented through a federally enforceable mechanism (40 CFR 93.158[a][2] and 40 CFR 93.158[a][5][iii]; 40 CFR 51.858[a][2] and 40 CFR 51.858[a][5][iii]).

- Conformity also can be demonstrated if the agency responsible for SIP preparation provides documentation that direct and indirect emissions associated with the federal agency action are accommodated within the emission forecasts contained in an approved SIP (40 CFR 93.158[a][5][i][A]; 40 CFR 51.858[a][5][i][A]).

- Finally, if SIP conformity cannot be demonstrated by the procedures noted above, a conformity determination is possible only if the relevant air quality management agency notifies EPA that appropriate changes will be made in the applicable SIP documents. The air quality management agency must commit to a schedule for preparing an acceptable SIP amendment that accommodates the net increase in direct and indirect emissions from the federal action without causing any delay in the schedule for attaining the relevant federal ambient air quality standard (40 CFR 93.158[a][5][i][B]; 40 CFR 51.858[a][5][i][B]).

All conformity determinations must also demonstrate that total direct and indirect emissions are consistent with all relevant requirements and milestones in the applicable SIP including:

- Reasonable further progress schedules,

- Assumptions specified in the attainment or maintenance demonstration, and

- SIP prohibitions, numerical emission limits, and work practice requirements.

3.0 FINAL RECORD OF NON-APPLICABILITY, PROJECT ALTERNATIVES AT NASNI

The NASNI project area would occur within the western portion of the San Diego Air Basin (SDAB), which is presently in nonattainment of the NAAQS for ozone and carbon monoxide and in attainment of all other standards. The EPA considers the SDAB to be a serious ozone and moderate carbon monoxide nonattainment area. The de minimis thresholds for the SDAB are 100 tons of carbon monoxide or 50 tons of volatile organic compounds or nitrogen oxides.

The proposed actions at NASNI that would change emissions within the SDAB include (1) removal of one CV, (2) addition of one CVN and removal of one CV, or (3) two additional CVNs and removal of one CV. The first action would not produce any new construction or operational emissions. The later two actions would be associated with both construction and operational emissions. Tables K-4 through K-34, at the end of this appendix, present data used to calculate emissions from the proposed actions at NASNI.

Construction

Construction activities associated with the one additional CVN and removal of one CV action would include (1) dredging the turning basin/quaywall area and associated disposal activities, (2) construction of a mitigation site by dredging activities, (3) dike construction and backfilling activities behind the new CVN berth, and (4) construction of a new CVN berth and support structures. Construction activities associated with the addition of a second CVN would require minor modifications to Berths L/M. Emissions sources associated with these activities would include diesel-powered tug boats, barge equipment, clamshell and hydraulic dredges, dredging sediment booster pumps, haul trucks, and assorted mobile construction equipment. Equipment usage associated with dredging and disposal activities were based on the same activities that were recently performed to homeport a BRAC CVN at NASNI (Radian International LLC 1998 and personal communications, John Rogers of SWDIV 1999) and communications with West Coast dredge contractors. Emissions estimated for the construction of the CVN berth were based on the same activities that were recently performed to homeport a BRAC CVN at NASNI (DON 1995a and personal communication, John Rogers of SWDIV 1999). Construction activities would begin in the year 2000 and be completed before the end of 2001 for the one additional CVN and removal of one CV action.

Table K-1 presents a summary of conformity-related construction emissions associated with the actions at NASNI. Since the dredging equipment would require air permits from the San Diego County Air Pollution Control District (SDCAPCD) and conformity rule excludes these emissions from the conformity requirements, they are not included in Table K-1 as part of this analysis. The peak annual conformity-related emissions would occur during the second year of construction for one additional CVN (year 2001) and would be associated with the scenario three dredging option. Peak annual construction conformity-related emissions associated with this scenario would amount to 2.5 tons of volatile organic compounds, 16.2 tons of carbon monoxide, and 23.9 tons of nitrogen oxides. All other annual conformity-related construction emissions associated with the proposed actions would be less than these amounts. These conformity-related increases in nonattainment pollutants are all less than the relevant de minimis levels for the SDAB. These emissions would also be well below 10 percent of the SDAB emission inventories for these pollutants. Consequently, construction of the homeporting project alternatives at NASNI would be exempt from Clean Air Act conformity determination requirements pursuant to 40 CFR 51.853(c)(1).

Operations

Operational impacts from the actions were determined by comparing the net change in emissions that would occur from (1) one additional CVN and removal of one CV or (2) the addition of two CVNs and removal of one CV. The first CVN would arrive and the first CV would depart in 2003, and the second CVN would arrive in 2005. Operational emissions associated with the second action at NASNI would include activities from the addition of one CVN, the removal of one CV, and the addition of a second CVN for 13 days per year. With the exception of CV vessel power plants and CVN propulsion plant maintenance, emission sources associated with the homeporting of a CVN or CV are similar and include (1) vessel auxiliary equipment, (2) onshore infrastructure, (3) routine shipboard maintenance, and (4) commuter vehicles.

Table K-1. Annual Construction Emissions from Homeporting Actions at NASNI and NAVSTA Everett

NASNI *Year/Construction Activity*	AIR POLLUTANT EMISSIONS (TONS/YEAR) *VOC*	 *CO*	 *NOx*
Year 2000			
Dredging/Disposal (1)	0.4	1.2	8.8
Construct Mitigation Site (1)	0.3	1.7	3.6
Diking/Backfilling	0.8	7.8	10.3
Annual Total	**1.6**	**10.7**	**22.8**
Year 2001			
Construct CVN Berth	2.5	16.2	23.9
Annual Total	**2.5**	**16.2**	**23.9**
Peak Year (2001)	**2.5**	**16.2**	**23.9**

Notes: 1 Emissions from dredging equipment not included, since they would be permitted by the SDCAPCD.

NAVSTA EVERETT *Year/Construction Activity*	AIR POLLUTANT EMISSIONS (TONS/YEAR) *VOC*	 *CO*	 *NOx*
Year 1			
Dredging - Pier A and North Wharf (1)	0.4	3.7	17.1
Dredging - North Wharf Only (2)	0.1	1.2	5.5
Peak Year (#1)	**0.4**	**3.7**	**17.1**

Notes 1 Data represent construction emissions associated with one additional CVN action, which would produce worst-case annual construction emissions of any action at NAVSTA Everett.
2 Dredging emissions for the North Wharf based on a volume of 50,000 cy.

VESSEL EMISSION SOURCES. Fuel oil-fired boilers provide the power for CVs and generate emissions of combustive air pollutants. Since the CVN is nuclear-powered, it does not have emissions associated with its power plant and consequently represents a net decrease in emissions from this source type in comparison to a CV. However, both vessels have onboard emergency diesel-powered electric generators, which are periodically tested while at berth. Other sources of auxiliary equipment include aircraft ground support equipment (would be operated occasionally for reliability checks and transit) and forklifts. Emissions of volatile organic compounds from oil water separator systems would also be included in this source category. It is assumed in this analysis that both vessels have the same auxiliary equipment requirements, except that emergency generator capacities and resulting testing emissions associated with a CVN would be greater than for a CV (DON 1995a).

INFRASTRUCTURE SOURCES. Emissions from onshore infrastructure sources associated with the homeporting of each vessel group were estimated from the 1997 NAVSTA Everett emissions inventory and in consultation with DON staff. The 1997 NAVSTA Everett emissions inventory includes activities from the homeporting of one CVN. Emissions from stationary sources that would occur from the homeporting of a CV, such as commuter vehicle fueling, were obtained by factoring CVN emissions data with the population ratio between the two vessel groups. Since off-site utility plants would provide the electrical power to generate the steam demand for each vessel, emissions from this activity are not presented in this analysis.

ROUTINE MAINTENANCE SOURCES. Shipboard routine maintenance (non-propulsion) activities occur at berth and would include painting, welding, and abrasive blasting. Emissions of PM_{10} and volatile organic compounds from routine maintenance activities would be similar for both vessel types.

PROPULSION PLANT MAINTENANCE SOURCES. Propulsion plant maintenance associated with the bi-annual PIA cycle for a CVN includes brazing and welding, paint and abrasive blasting, fiberglass lagging, surface coating, and solvent usage. Conditions of the SDCAPCD permit would limit depot maintenance facility (DMF) annual emissions from the PIA at 15 and 3 tons per year, respectively, for volatile organic compounds and PM_{10}. This emission rate would be achieved mainly with volatile organic compounds reducing measures, such as the dilution of the solvents (mainly acetone and isopropyl alcohol) used for hand-wiping operations with water or the substitution of solvents with cleaners not classified as volatile organic compounds. Since emissions from PIA maintenance would be permitted by the SDCAPCD, they are exempt from the conformity requirements and therefore not included in this analysis.

VEHICULAR SOURCES. Vehicle trips derived for the transportation section 3.9 of this FEIS were used to estimate project vehicle emissions associated with providing the capacity to homeport two additional CVNs. The average daily trips (ADT) associated with a CVN and CV at NASNI would be 5,530 and 5,353, respectively. However, the conformity analysis only includes vehicular emissions due to employee commutes, on-base delivery mileage, and government fleet vehicle mileage within the air basin. As a result, the ADT associated with a CVN and CV at NASNI were reduced to 2,992 and 2,896, respectively. Therefore, the net difference in ADT between the two vessel groups would be +96 in the year 2003. Beginning in the year 2005, the addition of a second CVN would generate an additional 2,992 ADT for 13 days per year within the NASNI project area. During these 13 days, on-base motorpool mileage associated with the CVN was also accumulated as part of the action. The average commuter vehicle trip length was assumed to be 13 miles (DON 1995a). This conformity analysis focused on commuter trips rather than all types of vehicle trips considered in section 3.10, Volume 1 of this EIS, such as truck deliveries. Therefore, the average vehicle speed for the conformity analysis was increased slightly, to simulate a greater percentage of driving conditions on freeways, versus local streets.

It is estimated that the state registration of project-related vehicles would be 70 percent for California and 30 percent for non-California states. Therefore, emissions for California and non-California registered vehicles were estimated with the EMFAC7G (ARB 1997) and the MOBILE5 (EPA 1993) models, respectively. Emission factors for the year 2003 were used to estimate vehicle emissions for the completion date of Alternatives Four, Five, or Six for either the proposed alternative or future no-project scenarios. Consistent with this approach, emission factors for the year 2005 were used to estimate vehicle emissions for the completion date of Alternatives One, Two, or Three. As implementation of state and federal vehicle emission standards would continue to reduce emissions per vehicle mile traveled (VMT) beyond 2003 and 2005, vehicle emissions would be less in future years than what is presented for the proposed actions in Table K-2.

Table K-2 presents a summary of the annual operational emissions that would occur from the two actions at NASNI. Table K-2 shows that the addition of one CVN and removal of one CV action during the year 2003 would reduce annual operational emissions of volatile organic compounds, carbon monoxide, and nitrogen oxides within the NASNI project region. Beginning in the year 2005, the action would also produce a net reduction in these emissions within the region. These emission reductions would be mainly due to the elimination of the CV power plants. Additionally, even though the action in the year 2005 would increase vehicular traffic by about seven percent from 2003 levels, vehicular emissions at this point in time would stay the same or slightly decrease from 2003 levels, as the future decreases in vehicular emissions factors would outweigh these traffic increases. For this reason, all future operational emissions associated with the proposed actions would be similar or less than the levels shown in Table K-2. These conformity-related nonattainment pollutant emissions are all less than the relevant de minimis levels for the SDAB. These emissions would also be well below 10 percent of the SDAB emission inventories for these pollutants. Consequently, operation of the homeporting project alternatives at NASNI would be exempt from Clean Air Act conformity determination requirements pursuant to 40 CFR 51.853(c)(1).

Table K-2. Annual Operational Emissions for the Homeporting Actions at NASNI – Conformity Analysis

Sources	Air Pollutant Emissions (tons/year)		
	VOC	*CO*	*NOx*
+1 CVN – 1 CV Alternative			
Addition of 1 CVN – 2003			
Vessels and Auxiliary Equipment	0.34	1.80	8.28
Onshore Infrastructure	1.83	0.00	0.00
Routine Maintenance	2.64	0.00	0.00
Commuter Vehicles	4.44	52.27	8.35
Total for 1 CVN	**9.25**	**54.06**	**16.63**
Removal of 1 CV – Year 2003			
Vessels and Auxiliary Equipment	(2.49)	(11.87)	(64.53)
Onshore Infrastructure	(1.83)	(0.00)	(0.00)
Routine Maintenance	(2.64)	(0.00)	(0.00)
Commuter Vehicles	(4.29)	(50.59)	(8.08)
Total for 1 CV	**(11.25)**	**(62.46)**	**(72.61)**
Net Change of +1 CVN – 1 CV – Year 2003	**(2.01)**	**(8.39)**	**(55.98)**
+2 CVNs – 1 CV Alternative			
Addition of 2 CVNs – Year 2005			
Vessels and Auxiliary Equipment	0.36	1.87	8.64
Onshore Infrastructure	2.37	0.00	0.00
Routine Maintenance	2.76	0.00	0.00
Commuter Vehicles	4.34	51.67	8.10
Total for 2 CVNs	**9.82**	**53.55**	**16.74**
Removal of 1 CV – Year 2005			
Vessels and Auxiliary Equipment	(2.49)	(11.87)	(64.53)
Onshore Infrastructure	(1.83)	(0.00)	(0.00)
Routine Maintenance	(2.64)	(0.00)	(0.00)
Commuter Vehicles	(3. 96)	(47.14)	(7.40)
Total for 1 CV	**(10.92)**	**(59.00)**	**(71.93)**
Net Change of +2 CVNs–1 CV – Year 2005	**(1.10)**	**(5.46)**	**(55.18)**

Note: (1) () Represents a net decrease in emissions.

(2) Even though the action in the year 2005 would increase vehicular traffic by about seven percent from 2003 levels, vehicular emissions at this point in time would stay the same or slightly decrease from 2003 levels, as the future decreases in vehicular emissions factors would outweigh these traffic increases.

4.0 FINAL RECORD OF NON-APPLICABILITY, PROJECT ALTERNATIVES AT NAVSTA EVERETT

The NAVSTA Everett project area would occur within the western portion of the Central Puget Sound Region (CPSR), which was historically in nonattainment of the NAAQS for carbon monoxide and ozone. Due to a reduction in emissions caused by national emission standards for new vehicles and a state vehicle emissions testing program, the region has attained both standards since 1991. Through the SIP process, the EPA redesignated the CPSR from nonattainment to attainment of the carbon monoxide and ozone NAAQS.

Consequently, the region is now considered a maintenance area for these two pollutants. The CPSR attains all other NAAQS. The de minimis thresholds for the CPSR are 100 tons of carbon monoxide, volatile organic compounds, or nitrogen oxides.

The proposed actions at NAVSTA Everett that would change emissions in the region would include (1) four additional AOEs and removal of one CVN, (2) one additional CVN, (3) two additional AOEs, or (4) removal of one CVN. These actions would be associated with both construction and operational emissions. Tables K-35 through K-57, at the end of this appendix, present data used to calculate emissions from the proposed actions at NAVSTA Everett.

Construction

Construction activities at NAVSTA Everett would vary by action: (1) four additional AOEs and removal of one CVN would require dredging in proximity to the North Wharf and associated disposal activities, installation of a dolphin mooring, and utility upgrades, (2) one additional CVN would require dredging in proximity to the North Wharf and Pier A and associated disposal activities and upgrades to facilities and structures, and (3) two additional AOEs would require dredging in proximity to the North Wharf and associated disposal activities, installation of a dolphin mooring, and utility upgrades. Emissions sources associated with these activities would include diesel-powered tug boats, barge equipment, clamshell dredges, haul trucks, and assorted mobile construction equipment. Construction emissions were estimated by the same methodology used for the NASNI analysis.

Table K-1 presents a summary of construction emissions associated with the actions at NAVSTA Everett. In general, construction activities would take place in the year 2000. The peak annual emissions would occur during the first year as part of the one additional CVN action and would amount to 0.4 tons of volatile organic compounds, 3.7 tons of carbon monoxide, and 17.1 tons of nitrogen oxides. All future construction emissions associated with the proposed actions would be less than these amounts. These conformity-related increases in nonattainment pollutants are all less than the relevant de minimis levels for the CPSR. These emissions would also be well below 10 percent of the CPSR emission inventories for these pollutants. Consequently, construction of the homeporting project alternatives at NAVSTA Everett would be exempt from Clean Air Act conformity determination requirements pursuant to 40 CFR 51.853(c)(1).

Operations

Operational impacts from the actions were determined by comparing the net change in emissions that would occur from (1) four additional AOEs and removal of one CVN, (2) one additional CVN, (3) two additional AOEs, or (4) removal of one CVN. The estimated times when any of these actions would occur is late 2000. Emissions for each action were estimated with a similar methodology used for the NASNI analysis.

Sources associated with the actions at NAVSTA Everett would be similar to those identified for NASNI with the following exceptions: (1) steam demand for each vessel group would be provided by on-site natural-gas fired boilers and (2) two AOEs would be powered by fuel oil-fired boilers and two would be powered by gas turbine units (the two additional AOE action would relocate boiler-powered vessels to NAVSTA Everett). Emissions from stationary sources that would occur from the homeporting of four AOEs, such as commuter vehicle fueling, were obtained by factoring CVN emissions data with the population ratio between the two vessel groups. Emissions from routine maintenance of the AOE vessel group were assumed to be double the emissions that would occur from one CVN. Emission calculations were also based on the operational characteristics of each vessel group (for example, emissions from CVN ground support equipment would not occur in association with AOEs). Factors used to estimate emissions for AOE boilers were obtained from special studies on vessel emissions (EPA 1995 and Booz, Allen, Hamilton 1991). Vehicle trips identified in the EIS transportation analysis were used to estimate commuter vehicle emissions. The alternative that would generate the most traffic would be the addition of one CVN: this alternative would generate an additional 4,194 average daily trips (ADT). The average length of each vehicle trip used in the analysis was 8 miles, based on the geographic distribution of housing locations for future CVN personnel. The EPA MOBILE 5a model was used to generate vehicle emissions from these data (EPA 1993).

The conformity analysis includes emissions associated with base-related travel and increased use of government vehicles. However, the conformity analysis excludes emissions associated with shopping and other household travel (including work trips by spouses employed elsewhere) and delivery truck off-site mileage are not under Navy control. As a result, the ADT generated by the addition of one CVN was reduced to 2,992. The conformity analysis also excludes the following emissions: (1) emissions from the steam production plant, since this source would be permitted by the Puget Sound Air Pollution Control Agency (PSAPCA) and (2) emissions associated with off-base housing units (space heating, water heating, etc.) not under Navy control.

Table K-3 presents a summary of the annual operational emissions that would occur from the four actions at NAVSTA Everett. These data show that the one additional CVN action in the year 2000 would produce the highest annual emissions of volatile organic compounds and carbon monoxide: 18.2 tons and 70.6 tons, respectively. The four additional AOEs and removal of one CVN action would produce the highest amount of NO_x emissions: 42.6 tons. Consequently, neither of these actions at NAVSTA Everett would exceed the de minimis levels for volatile organic compounds, carbon monoxide, or nitrogen oxides relevant to the CPSR. All other project alternatives at NAVSTA Everett would produce conformity-related nonattainment pollutants less than their relevant de minimis levels for the CPSR. The conformity-related nonattainment pollutants from each project alternative at NAVSTA Everett would be well below 10 percent of the CPSR emission inventories for these pollutants. Emission from all actions would decline slightly after 2000, due to elimination of construction emissions and more stringent motor vehicles emission standards (see Tables K-35 through K-43 at the end of this appendix). Consequently, operation of all homeporting project alternatives at NAVSTA Everett would be exempt from Clean Air Act conformity determination requirements pursuant to 40 CFR 51.853(c)(1).

Table K-3. Annual Operational Emissions for Homeporting Actions at NAVSTA Everett - Conformity Analysis

Sources	AIR POLLUTANT EMISSIONS (TONS/YEAR)		
	VOC	*CO*	*NOx*
Removal of 1 CVN			
Vessels and Auxiliary Equipment	(0.34)	(1.80)	(8.28)
Onshore Infrastructure	(6.61)	(0.00)	(0.00)
Routine Maintenance	(2.64)	(0.00)	(0.00)
Commuter Vehicles	(8.63)	(68.78)	(9.70)
Total and Net Change for -1 CVN	**(18.23)**	**(70.58)**	**(17.98)**
Removal of 1 CVN			
Vessels and Auxiliary Equipment	(0.34)	(1.80)	(8.28)
Onshore Infrastructure	(6.61)	(0.00)	(0.00)
Routine Maintenance	(2.64)	(0.00)	(0.00)
Commuter Vehicles	(8.63)	(68.78)	(9.70)
Total for -1 CVN	**(18.23)**	**(70.58)**	**(17.98)**
Addition of 4 AOEs			
Vessels and Auxiliary Equipment	2.44	5.03	52.38
Onshore Infrastructure	5.61	0.00	0.00
Routine Maintenance	5.28	0.00	0.00
Commuter Vehicles	5.60	44.43	6.30
Total for 4 AOEs	**18.93**	**49.46**	**58.68**
Net Change of -1 CVN + 4 AOEs	**0.70**	**(21.12)**	**40.70**
Addition of 1 CVN			
Construction Activities - Year 2000	0.28	1.57	2.66
Vessels and Auxiliary Equipment	0.34	1.80	8.28
Onshore Infrastructure	6.61	0.00	0.00
Routine Maintenance	2.64	0.00	0.00
Commuter Vehicles	8.63	68.78	9.70
Total and Net Change of +1 CVN	**18.23**	**70.58**	**17.98**
Addition of 2 AOEs			
Vessels and Auxiliary Equipment	1.20	1.71	10.69
Onshore Infrastructure	2.80	0.00	0.00
Routine Maintenance	2.64	0.00	0.00
Commuter Vehicles	3.03	24.08	3.42
Total and Net Change for +2 AOEs (1)	**9.86**	**27.20**	**14.11**

Note: () Represents a net decrease in emissions.

5.0 REFERENCES

Booz, Allen, Hamilton. 1991. *Inventory of Air Pollutant Emissions from Marine Vessels.*

California Air Resources Board (ARB). 1997. *EMFAC7G Vehicular Emissions Estimation Model.*

DON. 1995a. *Final Environmental Impact Statement for the Development of Facilities in San Diego/ Coronado to Support the Homeporting of One NIMITZ-Class Aircraft Carrier.* Naval Facilities Engineering Command, Southwest Division.

EPA. 1993. *MOBILE5 Mobile Source Emission Factor Model.*

Radian International LLC. 1998. *Final 1997 Emission Inventory Report for CVN Construction and Dredging Activities Naval Air Station, North Island.* Prepared for Southwest Division Naval Facilities Engineering Command.

Rogers, John. 1999. Engineer, Southwest Division Naval Facilities Engineering Command, San Diego.

Table K-4. Conformity-Related Emission Source Data Associated with Dike Construction at the NASNI Turning Basin/Quay Wall Area - CVN Homeporting Project - Scenario Three - All Clamshell Dredge.

Construction Activity/ Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Dredge Dike Footing with Clamshell								
Tug Boat	800	0.20	1	160	8.0	4	66	2,112
Disposal at LA-5 (1)								
Tug Boat	2,200	0.60	1	1,320	66.0	6.3	66	27,443
Rock Placement - Barge Dump (2)								
Tug Boat - Transport (3)	2,200	0.60	2	2,640	132.0	3.5	20	9,240
Tug Boat - Rock Dumping	2,200	0.20	2	880	44.0	1.0	20	880
Rock Placement - Clamshell (4)								
Tug Boat - Transport (3)	2,200	0.60	2	2,640	132.0	3.5	7	3,234
Tug Boat - Rock Unloading	2,200	0.10	2	440	22.0	4.0	7	616
Dike Filling								
Bulldozer - D6	140	0.60	1	84	4.3	8	60	2,056
Sweeper Truck	175	0.50	1	88	9.7	4	80	3,108
Vibratory Roller	140	0.60	1	84	4.3	6	60	1,542
Water Truck	175	0.50	1	88	4.5	4	80	1,428

Notes: (1) Based on a daily disposal rate of 4,000 cy (bulked), or two barge loads. Total disposal volume of 264,000 cy (bulked). Operations' beyone the 3 nm State Waters Boundary not included.

(2) Based on a daily/total placement rate of 6,000/118,500 tons.

(3) Barge capacity would be 3,000 tons. Operations beyond the 3 nm State Waters Boundary not included.

(4) Based on a daily/total placement rate of 6,000/39,500 tons.

Table K-5. Conformity-Related Emission Source Data Associated with Berth/Channel Dredging and Disposal Activities at NASNI Piers J/K - CVN Homeporting Project - Scenario Three - All Clamshell Dredge.

Construction Activity/ Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Clamshell Dredging								
Tug Boat	800	0.20	1	160	8.0	4	94	3,008
Disposal at LA-5 (1)								
Tug Boat	2,200	0.60	1	1,320	66.0	6.3	94	39,085

Notes: (1) Based on a daily disposal rate of 4,000 cy (bulked), or two barge loads. Total disposal volume of 376,800 cy (bulked). Operations beyond the 3 nm State Waters boundary not included.

Table K-6. Conformity-Related Emission Source Data for Construction of the Mitigation Site at Pier B - NASNI.

Construction Activity/ Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Land-based Sediment Removal (1)								
Excavator - Cat 235	250	0.50	1	125	6.4	8	80	4,080
Excavator - Cat 235	360	0.50	1	180	9.2	8	80	5,875
Bulldozer - D6	140	0.60	1	84	4.3	8	80	2,742
Loader - 966	200	0.20	1	40	2.0	8	80	1,280
Dump Truck - 15 cu yd loads (2)	NA	NA	11	NA	NA	40	80	35,200

Notes: (1) Based on a daily/total removal rate of 600/48,000 cy.

(2) Number Active are miles/round trip(between Pier B and Piers J/K), Hours/Day are the daily trips, and Total Fuel Use are annual miles

Table K-7. Emission Factors for Dredging/Disposal Activities at NASNI for the CVN Homeporting Project - Conformity Analysis.

Equipment Type	Fuel Type	Pounds/1000 Gallons (1)						Source
		VOC	CO	NOx	SO2	PM	PM10	
Tug Boats	D	19.0	57.0	419.0	75.0	9.0	8.6	(1)
Dozer	D	1.46	4.80	10.30	0.93	1.11	1.07	(2)
Excavator	D	0.91	5.20	10.75	0.93	1.44	1.38	(2)
Sweeper Truck	G	9.10	199.00	5.16	0.27	0.06	0.06	(2)
Vibratory Roller	D	1.02	3.10	9.30	1.00	0.78	0.75	(2)
Water Truck	D	1.08	2.80	9.60	0.89	0.80	0.77	(2)
Loader	D	1.06	4.80	10.30	0.86	1.29	1.24	(2)
Dump Trucks - 25 MPH	D	1.51	9.98	9.25	0.56	0.66	0.63	(3)

Notes: (1) Lloyd's Register of Shipping, London 1990, 1993, and 1995. From Acurex Env. Corp. 1996.

(2) Non-Road Engine and Vehicle Emission Study Report (EPA 1991), units in grams/hp-hr.

(3) From EMFAC7G (ARB 1997), units in grams/mile.

Table K-8. Conformity-Related Emissions Associated with Dike Construction at the NASNI Turning Basin/Quay Wall Area - CVN Homeporting Project - Scenario Three - All Clamshell Dredge.

	Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Dredge Dike Footing with Clamshell						
Tug Boat	0.0	0.1	0.4	0.1	0.0	0.0
Disposal at LA-5						
Tug Boat - Trans(1)	0.3	0.8	5.7	1.0	0.1	0.1
Rock Placement - Barge Dump						
Tug Boat - Transport	0.1	0.3	1.9	0.3	0.0	0.0
Tug Boat - Rock Dumping	0.0	0.0	0.2	0.0	0.0	0.0
Rock Placement - Clamshell						
Tug Boat - Transport	0.0	0.1	0.7	0.1	0.0	0.0
Tug Boat - Rock Unloading	0.0	0.0	0.1	0.0	0.0	0.0
Dike Filling						
Bulldozer - D6	0.1	0.2	0.5	0.0	0.0	0.0
Sweeper Truck	0.3	6.1	0.2	0.0	0.0	0.0
Vibratory Roller	0.0	0.1	0.3	0.0	0.0	0.0
Water Truck	0.0	0.1	0.3	0.0	0.0	0.0
Total Emissions - Tons	**0.8**	**7.8**	**10.3**	**1.7**	**0.3**	**0.3**

Note: (1) Does not include emissions that would occur beyond the 3-mile State Waters boundary.

Table K-9. Conformity-Related Emissions Associated with Berth/Channel Dredging and Disposal Activities at NASNI Piers J/K - CVN Homeporting Project - Scenario Three - All Clamshell Dredge.

	Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Clamshell Dredging						
Tug Boat	0.0	0.1	0.6	0.1	0.0	0.0
Disposal at LA-5 (1)						
Tug Boat	0.4	1.1	8.2	1.5	0.2	0.2
Total Emissions - Tons	**0.4**	**1.2**	**8.8**	**1.6**	**0.2**	**0.2**

Note: (1) Does not include emissions that would occur beyond the 3-mile State Waters boundary.

Table K-10. Conformity-Related Emissions for Construction of the Mitigation Site at Pier B - NASNI.

Construction Activity/	Tons					
Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Land-based Sediment Removal						
Excavator - Cat 235	0.1	0.5	0.9	0.1	0.1	0.1
Excavator - Cat 235	0.1	0.7	1.4	0.1	0.2	0.2
Bulldozer - D6	0.1	0.3	0.6	0.1	0.1	0.1
Loader - 966	0.0	0.1	0.3	0.0	0.0	0.0
Dump Truck - 15 cu yd loads	0.0	0.2	0.4	0.0	0.1	0.1
Total Emissions - Tons	**0.3**	**1.7**	**3.6**	**0.3**	**0.5**	**0.4**

Table K-11. Annual Conformity-Related Emissions at NASNI - Construction of the CVN Homeporting Project. Scenario Three - All Clamshell Dredge.

Year/Construction Activity	Tons per Year				
	VOC	CO	NOx	SOx	PM10
Year 1					
Turning Basin Dredging and Disposal	0.4	1.2	8.8	1.6	0.2
Mitigation Site Dredging and Disposal	0.3	1.7	3.6	0.3	0.4
Dike Construction	0.8	7.8	10.3	1.7	0.3
Annual Total	**1.6**	**10.7**	**22.8**	**3.6**	**0.9**
Year 2					
CVN Berth Construction (1)	2.5	16.2	23.9	2.2	1.5
Annual Total	**2.5**	**16.2**	**23.9**	**2.2**	**1.5**
Peak Year (2)	**2.5**	**16.2**	**23.9**	**3.6**	**1.5**

Notes: (1) Emissions assumed to be the same as those estimated for wharf construction associated with the BRAC CVN Project (DON 1995a).

(2) Peak annual emissions would occur during the first year of construction.

Table K-12. Commuter Composite Fleet Mix MOBILE 5 VOC Emission Factors - NASNI Year 2003.

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	5.65	5.49	75	7.02	6.66	20	9.90	9.34	4	7.43	7.32	1	6.00
25	1.65	1.56	75	2.00	1.84	20	2.79	2.54	4	2.55	2.83	1	1.72
55	0.95	0.90	75	1.24	1.15	20	1.72	1.57	4	1.94	2.27	1	1.02
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.48

Table K-13. Commuter Composite Fleet Mix MOBILE 5 CO Emission Factors - NASNI Year 2003.

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	60.54	50.70	75	70.89	58.36	20	98.10	81.81	4	98.23	87.68	1	59.17
25	18.11	15.16	75	21.86	17.93	20	29.58	24.58	4	18.37	16.40	1	17.71
55	8.05	6.74	75	11.02	9.09	20	15.28	12.77	4	9.21	8.22	1	8.21
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													13.61

Table K-14. Commuter Composite Fleet Mix MOBILE 5 NOx Emission Factors - NASNI Year 2003.

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	1.79	1.66	75	2.13	1.97	20	2.91	2.68	4	0.91	0.86	1	1.82
25	1.52	1.41	75	1.77	1.63	20	2.41	2.22	4	1.02	0.96	1	1.54
55	1.94	1.80	75	2.29	2.11	20	3.15	2.90	4	1.57	1.47	1	1.98
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.84

Table K-15. Commuter Composite Fleet Mix MOBILE 5 VOC Emission Factors - NASNI Year 2005.

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	5.42	5.25	75	6.67	6.32	20	9.33	8.81	4	7.43	7.32	1	5.74
25	1.60	1.51	75	1.93	1.77	20	2.69	2.45	4	2.55	2.83	1	1.67
55	0.91	0.87	75	1.20	1.10	20	1.65	1.51	4	1.94	2.27	1	0.98
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.42

Table K-16. Commuter Composite Fleet Mix MOBILE 5 CO Emission Factors - NASNI Year 2005.

	LDGV			*LDGT1*			*LDGT2*			*Motorcycle*			*Composite*
Speed	*Winter*	*Summer*	*%*	*Winter*	*Summer*	*%*	*Winter*	*Summer*	*%*	*Winter*	*Summer*	*%*	*Grams/Mile*
5	58.75	49.42	75	67.24	55.33	20	91.98	76.77	4	98.23	87.68	1	57.13
25	17.84	15.01	75	21.45	17.60	20	28.97	24.10	4	18.37	16.40	1	17.46
55	7.63	6.42	75	10.42	8.59	20	14.40	12.04	4	9.21	8.22	1	7.79
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													13.15

Table K-17. Commuter Composite Fleet Mix MOBILE 5 NOx Emission Factors - NASNI Year 2005.

	LDGV			*LDGT1*			*LDGT2*			*Motorcycle*			*Composite*
Speed	*Winter*	*Summer*	*%*	*Winter*	*Summer*	*%*	*Winter*	*Summer*	*%*	*Winter*	*Summer*	*%*	*Grams/Mile*
5	1.75	1.62	75	2.09	1.93	20	2.87	2.64	4	0.91	0.86	1	1.78
25	1.48	1.38	75	1.73	1.59	20	2.38	2.19	4	1.02	0.96	1	1.51
55	1.89	1.75	75	2.22	2.05	20	3.07	2.82	4	2.74	1.47	1	1.93
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.80

Table K-18. Commuter Composite Fleet Mix EMFAC7G VOC Emission Factors - NASNI Year 2003.

	LDA			LDT			MDT			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	0.76	0.72	75	0.83	0.81	20	1.30	1.34	4	8.75	8.66	1	0.86
25	0.20	0.19	75	0.22	0.22	20	0.35	0.36	4	2.26	2.23	1	0.23
55	0.12	0.12	75	0.13	0.13	20	0.21	0.22	4	1.39	1.37	1	0.14
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													0.20

Table K-19. Commuter Composite Fleet Mix EMFAC7G CO Emission Factors - NASNI Year 2003.

	LDA			LDT			MDT			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	15.08	14.60	75	15.38	14.91	20	13.70	13.61	4	52.98	52.42	1	15.23
	3.81	3.69	75	3.93	3.81	20	3.55	3.53	4	10.50	10.39	1	3.83
55	3.24	3.15	75	3.30	3.21	20	3.05	3.03	4	5.71	5.65	1	3.23
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													4.01

Table K-20. Commuter Composite Fleet Mix EMFAC7G NOx Emission Factors - NASNI Year 2003.

	LDA			LDT			MDT			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	1.08	0.87	75	1.66	1.35	20	2.32	1.90	4	0.82	0.71	1	1.12
25	0.47	0.38	75	0.72	0.59	20	1.01	0.82	4	0.92	0.79	1	0.49
55	0.84	0.68	75	1.32	1.07	20	1.84	1.51	4	1.39	1.20	1	0.89
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													0.78

Table K-21. Commuter Composite Fleet Mix EMFAC7G VOC Emission Factors - NASNI Year 2005.

	LDA			LDT			MDT			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	0.60	0.58	75	0.60	0.59	20	0.99	1.03	4	8.75	8.66	1	0.69
25	0.16	0.15	75	0.16	0.16	20	0.26	0.27	4	2.26	2.23	1	0.18
55	0.09	0.09	75	0.10	0.10	20	0.16	0.17	4	1.39	1.37	1	0.11
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													0.16

Table K-22. Commuter Composite Fleet Mix EMFAC7G CO Emission Factors - NASNI Year 2005.

	LDA			LDT			MDT			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	13.34	12.96	75	12.34	12.16	20	13.13	13.09	4	52.98	52.42	1	13.36
25	3.37	3.28	75	3.18	3.14	20	3.41	3.40	4	10.50	10.39	1	3.37
55	2.88	2.81	75	2.72	2.69	20	2.94	2.94	4	5.71	5.65	1	2.85
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													3.53

Table K-23. Commuter Composite Fleet Mix EMFAC7G NOx Emission Factors - NASNI Year 2005.

	LDA			LDT			MDT			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	0.92	0.75	75	1.41	1.14	20	2.00	1.64	4	0.82	0.71	1	0.96
25	0.40	0.32	75	0.61	0.50	20	0.87	0.71	4	0.92	0.79	1	0.42
55	0.72	0.58	75	1.11	0.91	20	1.59	1.30	4	1.39	1.20	1	0.76
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													0.67

Table K-24. Composite NASNI Commuter Vehicle VOC Emission Factors.

Year	*California Vehicle*	*Non-California Vehicle*	*Composite Grams/Mile (1)*
2003	0.20	1.48	0.58
2005	0.16	1.42	0.54

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal.

Table K-25. Composite NASNI Commuter Vehicle CO Emission Factors.

	California Vehicle	*Non-California Vehicle*	*Composite*
Year	*Auto*	*Auto*	*Grams/Mile (1)*
2003	4.01	13.61	6.89
2005	3.53	13.15	6.42

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal.

Table K-26. Composite NASNI Commuter Vehicle NOx Emission Factors.

	California Vehicle	*Non-California Vehicle*	*Composite*
Year	*Auto*	*Auto*	*Grams/Mile (1)*
2003	0.78	1.84	1.10
2005	0.67	1.80	1.01

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal.

Table K-27. Vehicle Miles Travelled for NASNI Alternative Components - Conformity Analysis.

Project Scenario/Year	*Week-day ADT*	*Week-end ADT(1)*	*Annual ADT(2)*	*Miles/ Trip*	*Total Annual Miles*
First Additional CVN/2003	2,992	598	529,584	13.0	6,884,592
Removal of First CV/2003	(2,896)	(579)	(512,592)	13.0	(6,663,696)
Second Additional CVN/2005 (3)	2,992	598	31,715	13.0	412,298
Onbase Motorpool Mileage (4)	NA	NA	NA	NA	8,000

(1) Week-end ADT assumed to be 20 percent of week-day estimates.

(2) Worst-case annual berthing of 229 days would occur in association with a PIA cycle. ADT are for commter trips only and exclude non-federal vehicle trips.

(3) Vehicle trips for the second CVN would occur for 13 days during the worst-case annual year.

(4) Represensts 13 days of operation per year with the presence of a second CVN.

Table K-28. Conformity-Related Annual Vehicle Emissions Associated with Operation of Alternatives 1, 2, or 3 at NASNI - Year 2005.

Project Scenario/Year	*Pounds per Year*		
	VOC	*CO*	*NOx*
First Additional CVN - Increment	8,176	97,402	15,264
Removal of First CV - Increment	(7,914)	(94,277)	(14,774)
Second Additional CVN - Increment	499	5,946	932
Total Emissions - Pounds	**762**	**9,071**	**1,422**
Total Emissions - Tons	**0.38**	**4.54**	**0.71**

Table K-29. Conformity-Related Annual Vehicle Emissions Associated with Operation of Alternatives 4 or 6 at NASNI - Year 2003.

Project Scenario/Year	*Pounds per Year*		
	VOC	*CO*	*NOx*
First Additional CVN - Increment	8,871	104,533	16,691
Removal of First CV - Increment	(8,586)	(101,179)	(16,155)
Total Emissions - Pounds	**285**	**3,354**	**536**
Total Emissions - Tons	**0.14**	**1.68**	**0.27**

Table K-30. Conformity-Related Annual Vehicle Emissions Associated with the Operation of Alternative 5 at NASNI - Year 2003.

Project Scenario/Year	*Pounds per Year*		
	VOC	*CO*	*NOx*
Removal of First CV - Increment	(8,586)	(101,179)	(16,155)
Total Emissions - Pounds	**(8,586)**	**(101,179)**	**(16,155)**
Total Emissions - Tons	**(4.29)**	**(50.59)**	**(8.08)**

Table K-31. The Net Change in Emissions from the Operation of Alternatives 1, 2, or 3 at NASNI, Year 2005 (+2 CVNs and - 1 CV).

-1 CV	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx	(122,000)				(6,820)					(4)		(244)	(14,774)	(143,842)	(71.92)	(71.92)
SOx	(134,000)				(460)					(0)		(16)		(134,476)	(67.24)	(67.24)
CO	(22,200)				(1,480)					(1)		(53)	(94,277)	(118,010)	(59.00)	(59.00)
PM	(24,600)	(5)			(500)					(0)		(15)	(294)	(25,414)	(12.71)	(13.19)
VOC	(4,400)				(560)	(1,421)	(1,264)	(5,282)		(0)		(23)	(7,914)	(20,865)	(10.43)	(10.92)
2 CVNs	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx					17,035					4		254	16,196	33,489	16.74	16.74
SOx					1,127					0		17		1,144	0.57	0.57
CO					3,695					1		55	103,348	107,099	53.55	53.55
PM		5			1,211					0		16	322	1,553	0.78	0.78
VOC					689	1,483	1,319	5,514		0		24	8,676	17,705	8.85	9.82
Net Change	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx	(122,000)				10,215					-		11	1,422	(110,352)	(55.18)	(55.18)
SOx	(134,000)				667					-		1		(133,332)	(66.67)	(66.67)
CO	(22,200)				2,215					-		2	9,071	(10,911)	(5.46)	(5.46)
PM	(24,600)	(0)			711					-		1	28	(23,861)	(11.93)	(12.42)
VOC	(4,400)				129	62	55	232		-		1	762	(3,159)	(1.58)	(1.10)

Notes: (1) Data for CV power plants and CV/CVN emergency generators obtained from FEIS San Diego Homeporting of One Nimitz Class Aircraft Carrier (DON 1995).

(2) GSE data obtained from Chief Rickabaugh of GSE AIRPAC Everett.

(3) Emissions for all other sources obtained from Table 5.10-2, Volume 5 and factored by populations for each vessel group (EFA Northwest Environmental Technical Department 1995 and 1997).

(4) Excludes sources with air permits, including OWPF, Natural Gas (NG) Boilers, and fuel tanks.

Table K-32. The Net Change in Emissions from the Operation of Alternatives 1, 2, or 3 at NASNI, Year 2005 - FSC Equivalent (+2 CVNs and - 1 CV).

-1 CV	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														-	0.00
CO														-	0.00
PM														-	0.00
VOC						474			497					(971)	(0.49)
2 CVNs	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														-	0.00
CO														-	0.00
PM														-	0.00
VOC						947			993					1,940	0.97
Net Change	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				-	-	-	-	-	-	-	-	-	-	-	0.00
SOx				-	-	-	-	-	-	-	-	-	-	-	0.00
CO				-	-	-	-	-	-	-	-	-	-	-	0.00
PM				-	-	-	-	-	-	-	-	-	-	-	0.00
VOC				-	-	473	-	-	496	-	-	-	-	969	0.48

Note: Excludes sources with air permits, including Natural Gas (NG) Boilers and fuel tanks.

Table K-33. The Net Change in Emissions from the Operation of Alternatives 4 or 6 at NASNI, Year 2003 (+1 CVN and - 1 CV).

-1 CV	*Emissions (Pounds per Year)*													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx	(122,000)				(6,820)					(4)		(244)	(16,155)	(145,222)	(72.61)	(72.61)
SOx	(134,000)				(460)					(0)		(16)		(134,476)	(67.24)	(67.24)
CO	(22,200)				(1,480)					(1)		(53)	(101,179)	(124,912)	(62.46)	(62.46)
PM	(24,600)	(5)			(500)					(0)		(15)	(294)	(25,414)	(12.71)	(12.71)
VOC	(4,400)				(560)	(1,421)	(1,264)	(5,282)		(0)		(23)	(8,586)	(21,537)	(10.77)	(11.25)

1 CVN	*Emissions (Pounds per Year)*													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx					16,320					4		244	16,691	33,258	16.63	16.63
SOx					1,080					0		16		1,096	0.55	0.55
CO					3,540					1		53	104,533	108,126	54.06	54.06
PM		5			1,160					0		15	304	1,484	0.74	0.74
VOC					660	1,421	1,264	5,282		0		23	8,871	17,521	8.76	9.25

Net Change	*Emissions (Pounds per Year)*													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx	(122,000)				9,500					-		-	536	(111,964)	(55.98)	(55.98)
SOx	(134,000)				620					-		-	-	(133,380)	(66.69)	(66.69)
CO	(22,200)				2,060					-		-	3,354	(16,786)	(8.39)	(8.39)
PM	(24,600)	(0)			660					-		-	10	(23,931)	(11.97)	(11.97)
VOC	(4,400)				100	-	-	-		-		-	285	(4,015)	(2.01)	(2.01)

Notes: (1) Data for CV power plants and CV/CVN emergency generators obtained from FEIS San Diego Homeporting of One Nimitz Class Aircraft Carrier (DON 1995).

(2) GSE data obtained from Chief Rickabaugh of GSE AIRPAC Everett.

(3) Emissions for all other sources obtained from Table 5.10-2, Volume 5 and factored by populations for each vessel group (EFA Northwest Environmental Technical Department 1995 and 1997).

(4) Excludes sources with air permits, including OWPF, Natural Gas (NG) Boilers, and fuel tanks.

Table K-34. The Net Change in Emissions from the Operation of Alternatives 4 or 6 at NASNI, Year 2003 - FSC Equivalent (+1 CVN and - 1 CV).

-1 CV	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														-	0.00
CO														-	0.00
PM														-	0.00
VOC						474			496					(970)	-0.48
1 CVN	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														-	0.00
CO														-	0.00
PM														-	0.00
VOC						474			496					970	0.48
Net Change	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														-	0.00
CO														-	0.00
PM														-	0.00
VOC						-			-					-	0.00

Note: Excludes sources with air permits, including Natural Gas (NG) Boilers and fuel tanks.

Table K-35. Commuter Composite Fleet Mix MOBILE 5 VOC Emission Factors - Everett Year 2000

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	7.00	6.81	70.9	9.81	9.07	25.5	12.55	11.55	2.5	11.62	13.80	1.1	7.74
25	1.95	1.82	70.9	2.81	2.51	25.5	3.46	3.04	2.5	4.02	7.66	1.1	2.16
55	1.15	1.09	70.9	1.80	1.66	25.5	2.20	1.96	2.5	3.07	6.89	1.1	1.34
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.91

Table K-36. Commuter Composite Fleet Mix MOBILE 5 CO Emission Factors - Everett Year 2000

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	68.94	44.88	70.9	99.59	66.61	25.5	126.27	88.04	2.5	128.26	109.78	1.1	65.53
25	19.87	12.79	70.9	28.78	18.85	25.5	34.12	23.04	2.5	23.98	20.53	1.1	18.61
55	9.70	6.29	70.9	16.20	10.86	25.5	19.63	13.52	2.5	12.02	10.29	1.1	9.66
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													15.14

Table K-37. Commuter Composite Fleet Mix MOBILE 5 NOx Emission Factors - Everett Year 2000

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	2.05	1.70	70.9	2.79	2.30	25.5	3.35	2.76	2.5	3.50	0.79	1.1	2.08
25	1.74	1.45	70.9	2.37	1.96	25.5	2.88	2.37	2.5	2.70	0.88	1.1	1.77
55	2.27	1.88	70.9	3.18	2.63	25.5	3.88	3.20	2.5	3.53	1.36	1.1	2.33
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													2.15

Table K-38. Commuter Composite Fleet Mix MOBILE 5 VOC Emission Factors - Everett Year 2005

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	6.06	5.74	70.9	8.56	7.71	25.5	10.57	9.47	2.5	11.62	13.80	1.1	6.65
25	1.77	1.59	70.9	2.52	2.17	25.5	3.07	2.57	2.5	4.02	7.66	1.1	1.92
55	1.03	0.94	70.9	1.58	1.40	25.5	1.91	1.62	2.5	3.07	6.89	1.1	1.18
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.67

Table K-39. Commuter Composite Fleet Mix MOBILE 5 CO Emission Factors - Everett Year 2005

	LDGV			LDGT1			LDGT2			Motorcycle			Composite
Speed	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Winter	Summer	%	Grams/Mile
5	61.10	39.74	70.9	83.56	52.62	25.5	101.11	65.18	2.5	128.26	109.78	1.1	56.50
25	18.50	12.03	70.9	26.49	16.56	25.5	31.57	20.17	2.5	23.98	20.53	1.1	17.20
55	7.97	5.18	70.9	13.08	8.27	25.5	16.02	10.38	2.5	12.02	10.29	1.1	7.84
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													13.08

Table K-40. Commuter Composite Fleet Mix MOBILE 5 NOx Emission Factors - Everett Year 2005

Speed	LDGV Winter	LDGV Summer	LDGV %	LDGT1 Winter	LDGT1 Summer	LDGT1 %	LDGT2 Winter	LDGT2 Summer	LDGT2 %	Motorcycle Winter	Motorcycle Summer	Motorcycle %	Composite Grams/Mile
5	1.93	1.62	70.9	2.70	2.24	25.5	3.33	2.76	2.5	0.98	0.79	1.1	1.97
25	1.64	1.38	70.9	2.24	1.85	25.5	2.76	2.29	2.5	1.09	0.88	1.1	1.67
55	2.09	1.75	70.9	2.89	2.40	25.5	3.58	2.97	2.5	1.68	1.36	1.1	2.13
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.99

Table K-41. Commuter Composite Fleet Mix MOBILE 5 VOC Emission Factors - Everett Year 2007

Speed	LDGV Winter	LDGV Summer	LDGV %	LDGT1 Winter	LDGT1 Summer	LDGT1 %	LDGT2 Winter	LDGT2 Summer	LDGT2 %	Motorcycle Winter	Motorcycle Summer	Motorcycle %	Composite Grams/Mile
5	5.89	5.50	70.9	8.41	7.50	25.5	10.41	9.25	2.5	11.62	13.80	1.1	6.45
25	1.74	1.53	70.9	2.48	2.12	25.5	3.04	2.53	2.5	4.02	7.66	1.1	1.88
55	1.00	0.91	70.9	1.54	1.36	25.5	1.87	1.58	2.5	3.07	6.89	1.1	1.14
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.63

Table K-42. Commuter Composite Fleet Mix MOBILE 5 CO Emission Factors - Everett Year 2007

Speed	LDGV Winter	LDGV Summer	LDGV %	LDGT1 Winter	LDGT1 Summer	LDGT1 %	LDGT2 Winter	LDGT2 Summer	LDGT2 %	Motorcycle Winter	Motorcycle Summer	Motorcycle %	Composite Grams/Mile
5	59.79	39.24	70.9	81.28	50.94	25.5	98.33	62.95	2.5	128.26	109.78	1.1	55.29
25	18.19	11.93	70.9	26.26	16.39	25.5	31.45	20.02	2.5	23.98	20.53	1.1	17.00
55	7.65	5.02	70.9	12.52	7.87	25.5	15.31	9.84	2.5	12.02	10.29	1.1	7.53
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													12.76

Table K-43. Commuter Composite Fleet Mix MOBILE 5 NOx Emission Factors - Everett Year 2007

Speed	LDGV Winter	LDGV Summer	LDGV %	LDGT1 Winter	LDGT1 Summer	LDGT1 %	LDGT2 Winter	LDGT2 Summer	LDGT2 %	Motorcycle Winter	Motorcycle Summer	Motorcycle %	Composite Grams/Mile
5	1.90	1.60	70.9	2.64	2.19	25.5	3.31	2.75	2.5	0.98	0.79	1.1	1.94
25	1.61	1.35	70.9	2.18	1.81	25.5	2.74	2.27	2.5	1.09	0.88	1.1	1.63
55	2.04	1.72	70.9	2.80	2.33	25.5	3.53	2.93	2.5	1.68	1.36	1.1	2.08
Composite emission factor based on 5 percent at 5 mph, 30 percent at 25 mph, and 65 percent at 55 mph.													1.94

Table K-44. Vehicle Miles Travelled for Everett Alternative Components - Conformity Analysis.

Project Scenario	Week-day ADT	Week-end ADT(1)	Annual ADT	Miles/ Trip	Total Annual Miles
+4 AOEs (2)	2,231	446	332,865	8.0	2,662,922
+1 CVN (3)					
+1 CVN - Berthed	2,992	598	491,286	8.0	3,930,291
+1 CVN - Onbase Mileage for Motorpool (4)	NA	NA	NA	NA	150,000
+2 AOEs (2)	1,209	242	180,383	8.0	1,443,062

(1) Week-end ADT assumed to be 20 percent of week-day estimates.

(2) Annual berthing of 186 days assumed for an AOE.

(3) Represents a worst-case annual emissions scenario for a +1 CVN action at NAVSTA Everett. At berth time would be 213 days ADT are for commter trips only and exclude non-federal vehicle trips.

(4) (USN Public Works, NAVSTA Everett 1998).

Table K-45. Annual Vehicle Emissions for Everett Alternatives.

Project Scenario/Year	Pounds per Year		
	VOC	CO	NOx
+4 AOEs/2000	11,199	88,856	12,605
+1 CVN/2000	17,266	137,560	19,391
+2 AOEs/2000	6,069	48,152	6,831
+4 AOEs/2000 Tons/Yr	**5.60**	**44.43**	**6.30**
+1 CVN//2000 Tons/Yr	**8.63**	**68.78**	**9.70**
+2 AOEs/2000 Tons/Yr	**3.03**	**24.08**	**3.42**

Table K-46. Boiler- and Gas Turbine-powered AOE Annual Operational Data Associated with the Homeporting Project Alternatives.

Vessel Type/ Mode	*# of Vessels*	*# of Units*	*Hp/ Units*	*Hours/ Roundtrip*	*Load Factor*	*Hp-Hrs/ Roundtrip*	*Annual Roundtrip*	*Fuel Use/ Roundtrip*	*Annual Fuel Usage (1)*
Boiler - Maneuver	2	4		1	0.44		40	1,696	67,840
Boiler - Idle	2	4		25	0.20		40	19,250	770,000
Turbine - Man.	2	4	25,000	2	0.46	184,000	40		7,360,000
Turbine - Ilde	2	4	25,000	2	0.40	160,000	40		6,400,000

Notes: (1) For turbine vessel, represents annual Hp-Hrs.

(2) Boiler vessel idle and maneuver hourly fuel usages are 385 and 848 gallons, respectively.

Table K-47. AOE Onboard Generator Annual Operational Data.

Operating Mode	*# of Vessels*	*# of Units*	*Hp/ Units*		*Load Factor*		*Annual Hours*		*Annual Fuel Usage*
Boiler Vessel	2	1	1,341		0.25		24		837
GT Vessel	2	5	3,353		0.25		24		10,461

Table K-48. Emissions Factors for AOE Onboard Sources.

Operating	*% Sulfur*	*Emission Factors (Lbs/1000 Gal)(1)*						
Mode	*in Fuel*	*VOC*	*CO*	*NOx*	*SOx*	*PM*	*PM10*	*Source*
Boiler - Maneuver	0.5	0.7	3.5	55.8	78.5	20.0	19.2	(2)
Boiler - Idle	0.5	3.0	4.0	22.2	71.0	15.0	14.4	(2)
Gas Turbines		0.1	0.2	2.5	1.8	0.2	0.2	(3)
Generators	0.3	57.6	130.2	604.2	39.7	39.5	37.9	(4)

Notes: (1) Grams/Hp-Hr for gas turbine vessels.

(2) (BAH 1991).

(3) AP-42, Volume I, section 3.1 (EPA 1995).

(4) AP-42, Volume I, Table 3.3-1 (EPA 1995).

Table K-49. Annual Emissions for AOE Operations at Berth.

Activity	*Pounds*					
	VOC	*CO*	*NOx*	*SOx*	*PM*	*PM10*
Maneuver - Steam	47	237	3,785	5,325	1,357	1,303
Idle - Steam	2,310	3,080	17,094	54,670	11,550	11,088
Maneuver - GT	1,006	2,823	41,213	29,855	3,602	3,458
Idle - GT	875	2,455	35,838	25,961	3,132	3,007
Boiler Generators	48	109	506	33	33	32
GT Generators	603	1,362	6,321	415	413	397
AOE Subtotal	**4,238**	**8,596**	**97,931**	**115,812**	**19,641**	**18,856**
AOE - Tons	**2.12**	**4.30**	**48.97**	**57.91**	**9.82**	**9.43**
Gens Subtotal	**651**	**1,471**	**6,826**	**449**	**446**	**428**
Gens - Tons	**0.33**	**0.74**	**3.41**	**0.22**	**0.22**	**0.21**

Table K-50. 1995 and 1997 NS Everett Emissions Inventory and Estimate of Operational Conformity-Related Emissions for +1 CVN at NS Everett.

1995 Inventory	Emissions (Pounds per Year)														TOTAL EMISSIONS		TOTAL NSE + FSC
	Abr Blasting	OWPF	NG Boilers	Em Gens Onshore		Fiber glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx			1,139	504							10				1,653	0.83	1.0
SOx			7	33							0				40	0.02	0.0
CO			239	109							2				349	0.17	0.2
PM	2		137	37							0				176	0.09	0.1
VOC		63	66	41		3	1,579	632	2,641	514	0	1			5,540	2.77	3.2
1997 Projection	Emissions (Pounds per Year)														TOTAL EMISSIONS		TOTAL NSE + FSC
	Abr Blasting	OWPF	NG Boilers	Em Gens Onshore		Fiber glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx			39,520	504							23				40,047	20.02	20.3
SOx			282	33							0				315	0.16	0.2
CO			10,010	109							4				10,122	5.06	5.1
PM	18		3,919	37							1				3,975	1.99	2.0
VOC		4,683	1,667	41		3	4,736	5,361	21,130	4,112	1	10,460			52,193	26.10	32.2
1 CVN Increment (6)	Emissions (Pounds per Year)														TOTAL EMISSIONS		TOTAL NSE + FSC
	Abr Blasting	OWPF	NG Boilers	Em Gens Onshore	Em Gens Onboard	Fiber glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx				-	16,320					-	4		244	19,391	35,959	17.98	17.98
SOx				-	1,080					-	0		16		1,096	0.55	0.5
CO				-	3,540					-	1		53	137,560	141,153	70.58	70.6
PM	5			-	1,160					-	0		15	180	1,360	0.68	0.7
VOC				-	660		1,421	1,264	5,282	-	0	5,021	23	17,266	30,937	15.47	18.2

Notes: (1) 1995 and 1997 emission inventories derived by EFA Northwest Environmental Technical Department (1995 and 1997).

(2) 1995 Janitorial supplies VOC revised to one third of 1997 value, since 1997 value is 3 times actual.

(3) 95 VOC for OWPF not calculated for 1995, but 1997 estimated to be 8 times the value of 1995.

(4) Emissions for emergency generators onboard a CVN obtained from SD EIS (DON 1995).

(5) GSE operational data for a CVN obtained from Chief Rickabaugh of GSE AIRPAC Everett.

(6) Excludes sources with air permits, including OWPF and Natural Gas (NG) Boiler emissions.

Table K-51. 1995 and 1997 NS Everett Emissions Inventory and Estimate of Conformity-Related Operational Emissions for 1 CVN at the FSC.

1995 Inventory	Emissions (Pounds per Year)														TOTAL EMISSIONS	
	Abr Blasting	OWPF	NG Boilers	Em Gens		Fiber glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				336											336	0.17
SOx				22											22	0.01
CO				73											73	0.04
PM				25											25	0.01
VOC				27			526			345		-			898	0.45
1997 Inventory	Emissions (Pounds per Year)														TOTAL EMISSIONS	
	Abr Blasting	OWPF	NG Boilers	Em Gens		Fiber glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				504											504	0.25
SOx				33											33	0.02
CO				109											109	0.05
PM				37											37	0.02
VOC				41			1,579			1,034		9,478			12,132	6.07
1 CVN Increment (6)	Emissions (Pounds per Year)														TOTAL EMISSIONS	
	Abr Blasting	OWPF	NG Boilers	Em Gens		Fiber glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx															-	0.00
SOx															-	0.00
CO															-	0.00
PM															-	0.00
VOC							474			496		4,549			5,519	2.76

Notes: (1) 1995 Janitorial supplies VOC revised to one third of 1997 value, since 1997 value is 3 times actual.

(2) Excludes sources with air permits, including Natural Gas (NG) Boilers and fuel tanks.

Table K-52. Conformity-Related Emissions from the Operation of + 4 AOEs and - 1 CVN at NS Everett.

+4 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NSE + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	97,931				6,826					(8)			12,605	117,354	58.68	58.68
SOx	115,812				449					0				116,261	58.13	58.13
CO	8,596				1,471					(1)			88,856	98,921	49.46	49.46
PM	19,641	9			446					0			117	20,214	10.11	10.11
VOC	4,238				651	947	2,528	10,564		0	3,661		11,199	33,788	16.89	18.93
-1 CVN (4)	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NSE + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx					(16,320)				-	(4)		(244)	(19,391)	(35,959)	(17.98)	(17.98)
SOx					(1,080)				-	0		(16)		(1,096)	(0.55)	(0.55)
CO					(3,540)				-	(1)		(53)	(137,560)	(141,153)	(70.58)	(70.58)
PM		(5)			(1,160)				-	0		(15)	(180)	(1,360)	(0.68)	(0.68)
VOC					(660)	(1,421)	(1,264)	(5,282)	-	0	(5,021)	(23)	(17,266)	(30,937)	(15.47)	(18.23)
Net Change	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NSE + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	97,931				(9,494)					(12)		(244)	(6,786)	81,396	40.70	40.70
SOx	115,812				(631)					0		(16)	-	115,165	57.58	57.58
CO	8,596				(2,069)					(2)		(53)	(48,705)	(42,232)	(21.12)	(21.12)
PM	19,641	4			(714)					0		(15)	(62)	18,854	9.43	9.43
VOC	4,238				(9)	(474)	1,264	5,282		0	(1,360)	(23)	(6,067)	2,851	1.43	0.70

Notes: (1) Data for most emission source categories obtained from Table K- 5.10-3, Volume 5 (EFA Northwest Environmental Technical Department 1995 and 1997).

(2) AOE power plant and onboard generator emissions based on data provided by NS Seattle.

(3) GSE data obtained from Chief Rickabaugh of GSE AIRPAC Everett.

(4) Excludes sources with air permits, including OWPF and Natural Gas (NG) Boiler emissions.

Table K-53. Conformity-Related Emissions from the Operation of + 4 AOEs and - 1 CVN at FSC.

+4 AOEs	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														-	0.00
CO														-	0.00
PM														-	0.00
VOC						395			362		3,317			4,074	2.04
-1 CVN (1)	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														-	0.00
CO														-	0.00
PM														-	0.00
VOC						(474)			(496)		(4,549)			(5,519)	-2.76
Net Change	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														-	0.00
CO														-	0.00
PM														-	0.00
VOC						869			858		7,866			9,593	4.80

Note: Excludes sources with air permits, including Natural Gas (NG) Boilers and fuel tanks.

Table K-54. Conformity-Related Emissions from the Operation of + 2 AOEs at NAVSTA Everett.

2 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NSE + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	20,879				506					4			6,831	28,220	14.11	14.11
SOx	59,995				33					0				60,029	30.01	30.01
CO	3,317				109					1			48,152	51,579	25.79	25.79
PM	12,907	5			33					0			64	13,008	6.50	6.50
VOC	2,357				48	474	1,264	5,282		0	1,831		6,069	17,324	8.66	9.68

Table K-55. Conformity-Related Emissions from the Operation of + 2 AOEs at FSC.

2 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx														-	0.00
SOx														0	0.00
CO														-	0.00
PM														-	0.00
VOC						198			181		1,659			2,038	1.02

Note: Excludes sources with air permits, including Natural Gas (NG) Boilers and fuel tanks.

Table K-56. Emission Source Data for Dredging Pier A and the North Wharf at NAVSTA Everett.

Construction Activity/Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Dredging(1)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	24	47	34,517
Dredge - Main Generator	900	0.50	1	450	23.0	24	47	25,888
Dredge - Deck Generator	240	0.60	1	144	7.3	5	47	1,726
Tug Boat	800	0.20	1	160	8.0	4	47	1,504
Ocean Disposal (2)								
Tug Boat	2,200	0.60	1	1,320	66.0	2.0	47	6,204

Notes: (1) Based on a daily dredging rate of 3,333 cubic yards (cy), or 4,000 cy with a 1.2 bulk factor. Total dredging volume would be 155,000 cy, or 186,000 cy with a 1.2 bulk factor. Dredging volume for the north wharf would be 50,000 cy of the 155,000 cy.

(2) Based on a daily disposal rate of 4,000 cy (bulked), or two barge loads. Total disposal volume of 186,000 cy (bulked). Round trip distance to the ocean disposal site would be 4.5 miles and an average speed of 5 mph.

Table K-57. Emission Factors for Dredging/Disposal Activities at NAVSTA Everett - CVN Homeporting.

Equipment Type	*Fuel Type*	*Pounds/1000 Gallons (1)* *VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*	*Source*
Stationary Engines >600 Hp	D	11.1	111.0	424.8	39.5	13.6	13.3	(1)
Stationary Engines <600 Hp	D	43.3	129.3	600.2	39.5	42.2	41.4	(2)
Tug Boats	D	19.0	57.0	419.0	75.0	9.0	8.8	(3)

Notes: (1) AP-42, Table 3.4-1, Vol. I (EPA 1996).

(2) AP-42, Table 3.3-1, Vol. I (EPA 1996).

(3) Lloyd's Register of Shipping, London 1990, 1993, and 1995. From Acurex Env. Corp. 1996.

Table K-58. Emissions for Complete Dredging Action at NAVSTA Everett - CVN Homeporting.

Construction Activity/Equipment Type	*Total Tons* *VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Dredging						
Dredge - Main Hoist (1)	0.2	1.9	7.3	0.7	0.2	0.2
Dredge - Main Generator (1)	0.1	1.4	7.8	0.5	0.2	0.2
Dredge - Deck Generator (1)	0.0	0.1	0.4	0.0	0.0	0.0
Tug Boat	0.0	0.0	0.3	0.1	0.0	0.0
Ocean Disposal						
Tug Boat Transport	0.1	0.2	1.3	0.2	0.0	0.0
Total Emissions - Tons	**0.4**	**3.7**	**17.1**	**1.5**	**0.5**	**0.5**
North Wharf Dredging Emissions - Tons	**0.1**	**1.2**	**5.5**	**0.5**	**0.2**	**0.2**

NAVY RECORD OF NON-APPLICABILITY FOR CLEAN AIR ACT CONFORMITY

The proposed Navy action falls under the Record of Non-Applicability (RONA) category and is documented with this RONA.

Proposed Action.

Activity: Naval Air Station North Island San Diego, California (NASNI)
Proposed Action Name: Developing Home Port Facilities for Three Nimitz-Class Aircraft Carriers in Support of the U.S. Pacific Fleet
Proposed Action & Emissions Summary: The air quality analysis in the Environmental Impact Statement (EIS) of the proposed action determined that construction and operational emissions would be below the de minimis thresholds and therefore would show conformity under the Clean Air Act, as amended (CAA).
Affected Air Basin(s): San Diego Air Basin, California (SDAB)
Date RONA prepared: March 17, 1998
RONA prepared by: Chris Crabtree, air quality specialist, Science Applications International, Inc., (805) 966-0811.

Proposed Action Relative to Exemptions. The proposed action is not among the listed exemptions from Conformity Determination requirements.

Attainment Area Status and Emissions Evaluation Conclusion. The SDAB is a serious ozone (O_3) and moderate carbon monoxide (CO) nonattainment area. The annual de minimis thresholds for these pollutants to show conformity are 100 tons for CO and 50 tons for nitrogen oxides (NO_x) and volatile organic compounds (VOC) (NO_x and VOC are precursors to O_3 formation). The Navy's evaluation leads to the conclusion that de minimis thresholds for these pollutants in the nonattainment areas would not be exceeded. The Navy therefore concludes that further formal Conformity Determination procedures are not required, resulting in this Record of Non-Applicability.

RONA Approval:

Signature: D F Steuer
Name/Rank: D.F. STEUER, Captain, USN Date: 4-2-98
Position: Commanding Officer Activity: NAS North Island

NAVY RECORD OF NON-APPLICABILITY FOR CLEAN AIR ACT CONFORMITY

The proposed Navy action falls under the Record of Non-Applicability (RONA) category and is documented with this RONA.

Proposed Action.

Activity: Naval Station Everett, Washington (NAVSTA Everett)

Proposed Action Name: Developing Home Port Facilities for Three Nimitz-Class Aircraft Carriers in Support of the U.S. Pacific Fleet

Proposed Action & Emissions Summary: The air quality analysis in the Environmental Impact Statement (EIS) of the proposed action determined that construction and operational emissions would be below the de minimis thresholds and therefore would show conformity under the Clean Air Act, as amended (CAA).

Affected Air Basin(s): Central Puget Sound Region, Washington (CPSR)

Date RONA prepared: June 9, 1999

RONA prepared by: Chris Crabtree, air quality specialist, Science Applications International, Inc., (805) 966-0811.

Proposed Action Relative to Exemptions. The proposed action is not among the listed exemptions from Conformity Determination requirements.

Attainment Area Status and Emissions Evaluation Conclusion. The CPSR is an ozone (O_3) and carbon monoxide (CO) maintenance area. The annual de minimis thresholds for these pollutants to show conformity are 100 tons for CO, nitrogen oxides (NO_x), and volatile organic compounds (VOC) (NO_x and VOC are precursors to O_3 formation). The Navy's evaluation leads to the conclusion that de minimis thresholds for these pollutants in the maintenance areas would not be exceeded. The Navy therefore concludes that further formal Conformity Determination procedures are not required, resulting in this Record of Non-Applicability.

RONA Approval:

Signature: [signature]

Name/Rank: K.S. BUIKE, CAPT. USN Date: 10 JUNE 1999

Position: Commanding Officer Activity: NAVAL STATION EVERETT

APPENDIX L

LIFE CYCLE COST ANALYSIS

APPENDIX L

LIFE CYCLE COST ANALYSIS

1.0 INTRODUCTION

This cost analysis correlates with the Environmental Impact Statement (EIS) for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U. S. Pacific Fleet. The scope of that EIS is to: (1) determine the appropriate home port for two CVNs that will replace two CVs currently homeported at NASNI, and (2) reevaluate the current location of one CVN at NAVSTA Everett. The EIS does not reexamine the existing CVN homeporting of the USS JOHN C. STENNIS at NASNI or the USS CARL VINSON at PSNS.

The EIS evaluates six alternatives involving four locations. From Table ES-1 of the EIS, the following alternatives are considered in the EIS:

Numbers of CVNs and AOEs at Home Port Location Alternatives

	EIS ALTERNATIVES					
Home Port Locations	*One*	*Two*	*Three*	*Four*	*Five*	*Six (No Action)*
NASNI	3	3	3	2	1	2
PSNS	2	$1_{(4)}$	$1_{(4)}$	$1_{(4)}$	$2_{(2)}$	$2_{(4)}$
NAVSTA Everett	$0_{(4)}$	1	0	2	$1_{(2)}$	1
PHNSY	0	0	1	0	1	0

The number of AOEs is subscript; the number of CVNs is not.

The numbers in the table above are the total numbers of CVNs and AOEs to be homeported at each location for each alternative. The total numbers includes CVNs that are not part of the EIS scope and are currently homeported at NASNI (USS JOHN C. STENNIS) and PSNS (USS CARL VINSON).

This cost analysis does however involve ships currently homeported at the alternative locations: at NASNI - two conventionally-powered aircraft carriers (CV), at PSNS - four fast combat support ships (AOE), and at NAVSTA Everett - one NIMITZ-Class nuclear-powered aircraft carrier (CVN). As such, this cost analysis includes ships for which the Navy is already incurring homeporting costs. New costs that the Navy has not incurred before will result due to the two CVNs which will replace the CVs and due to choices associated with the different alternatives.

The purpose of this analysis is to compare the costs associated with taking no action to the costs associated with each of the other alternatives in order to evaluate the viability of each alternative. Part of the cost for any alternative involves ships for which the Navy already incurs cost; these costs can be called the costs associated with maintaining the status quo. The costs of maintaining the status quo are common to each alternative. The other part of the costs for any alternative involves new costs. The first objective of this analysis will be to identify the costs associated with homeporting that are within the scope of the EIS, and to estimate the dollar value of those costs.

Section 2 of this cost analysis identifies and estimates the varied costs associated with homeporting and which are within the scope of the EIS. Section 3 compares the costs of alternatives and presents the formulas used to determine the difference in cost between each alternatives and taking no action (Alternative 6). Section 4 presents cost data in spreadsheet format.

2.0 IDENTIFYING AND ESTIMATING COSTS

For the purpose of organizing and identifying costs associated with CVN homeporting, costs have been grouped in three major categories: construction, operational, and housing. Within each of the major categories, sub-categorization provides details for understanding the source of cost.

Where appropriate, costs are normalized over a 30 year life cycle. The formula used was $P=A*\{[(1+i)^n]/[i*(1+i)^n]\}$, where P = present value, A = annual cost, i = discount rate, and n = life cycle period. A life cycle period (n) of 30 years and a discount rate (i) of 0.038 were used based on guidance contained in NAVFAC P-442, Economic Analysis Handbook. Inflation growth was not applied to recurring costs. All construction costs were escalated to 2000. Area cost factors were used to compare similar projects in different locations. The area cost factors are from the NAVFAC Area Cost Factor Indexes, Table B dated 28 May 1997, and are as follows: San Diego, 1.15; Pacific Northwest, 1.09; Pearl Harbor, 1.45.

2.1 Construction/Renovation Costs

Costs associated with possible new construction or renovation of facilities at each CVN homeporting location are summarized in the table below. It is generally uncertain as to what year new construction cost will be incurred.

2.1.1 NASNI

Construction/Renovation Projects	$ Cost	Applicable Alternatives
CVN Berthing Wharf and miscellaneous structures (P-700A)	54,440,000	1,2,3,4
Berth L/M Modifications	1,200,000	1,2,3

*2.1.2 PSNS**

Construction/Renovation Projects	$ Cost	Applicable Alternatives
Second CVN Utility Upgrades	1,900,000	1,5

*Pier renovation and dredging projects ($81.5M) at PSNS are not included in the cost analysis because their costs apply equally to alternatives 1 through 5 and provide no cost differential for choosing between alternatives.

2.1.3 NAVSTA Everett

Construction/Renovation Projects	$ Cost	Applicable Alternatives
CVN:		
Electrical - 4160 volt	2,300,000	4
Parking Structure	8,000,000	4
Hazardous Waste Facility	1,900,000	4,5
Transit Shed	5,500,000	4
Steam Plant	1,500,000	4
Oil Waste Tanks	920,000	4
Dredge Pier A	1,200,000	4
North Wharf:		
Dredging	450,000	1,4,5
Utilities	3,375,000	1,4,5
Structural Repairs	550,000	1,4,5
AOE:		
Mooring Dolphins	270,000	1,5
Electrical upgrade	2,500,000	1,5

2.1.4 PHNSY

Construction/Renovation Projects	$ Cost	Applicable Alternatives
Dredging	31,920,000	3,5
CIF	72,120,000	3,5
Pump/Valve Test Facility	6,500,000	3,5
Pure Water	3,000,000	3,5
Utility and structural upgrades	7,400,000	3,5
Parking Garage and demolition	12,700,000	3,5
Drydock #4 upgrades	6,250,000	3,5
Personnel support facilities	6,700,000	3,5

2.2 Operational Costs

2.2.1 Facility Costs

2.2.1.1 *Operation and Maintenance for Facilities*

The annual cost of operation and maintenance of facilities is calculated to be 2% construction/renovation costs. Two percent of a facility's construction/renovation cost is the industry norm for calculating annual operation and maintenance budgets to keep the facility in good condition over a 30 year life span. Operation and maintenance costs for facilities were normalized over a 30-year life cycle using the formula discussed in Section 2.0.

2.2.1.2 Utility Costs for Facilities

The cost of utilities for a facility over a 30-year life is estimated to be 5% of the construction/renovation costs for that facility.

2.2.2 Moving Costs

2.2.2.1 Maintenance Worker Temporary Duty (TDY) Costs

Only qualified personnel are allowed to perform nuclear propulsion plant maintenance. The only homeport alternative location with personnel qualified to work on a CVN nuclear propulsion plant is PSNS. A qualified work force would have to be sent to other homeport alternative locations to perform CVN nuclear propulsion plant maintenance.

NASNI TDY

Qualified personnel must be sent temporarily to NASNI from a nuclear-capable shipyard to support CVN maintenance work. The total per diem, round-trip travel, and miscellaneous costs per PIA to send a qualified work force to NASNI has been estimated to be $8,492,000.

Two PIAs per CVN will be performed every 77 months, which when annualized, is $2,646,857 per year (2PIAs x $8,492,000 x 12/77). The 30-year life cycle cost for each CVN in San Diego would be $46,901,783 per CVN. This NASNI estimate is also used for to estimate the cost of PIA work at PHNSY.

PHNSY TDY

PHNSY does not have enough qualified personnel to perform nuclear and non-nuclear propulsion plant maintenance on a CVN and there is insufficient ship repair work at PHNSY to justify a higher manning level. Qualified personnel would need to be sent temporarily to PHNSY to support CVN maintenance work. The total per diem, travel and miscellaneous cost to send a qualified work force to PHNSY has been estimated to be for a PIA at $19,243,300 (PSNS analysis dated 18 Feb 98) and for a DPIA at $30,181,030.

Two PIAs will be performed every 77 months, which when annualized, is $5,997,911 per year. The 30-year life cycle cost for PIA maintenance is $106,281,792 for a CVN at PHNSY.

One DPIA will be performed every 77 months, which when annualized, is $4,703,537 per year. The 30-year life cycle cost for DPIA activity is $83,345,742 for a CVN at PHNSY.

The total PIA/DPIA life cycle cost for PHNSY is $189,627,549.

2.2.2.2 Ship's Crew Permanent Change of Station (PCS) Costs

PCS costs are incurred when a ship changes its homeport. The costs are associated with moving families of the crew from the old to the new homeport. PCS costs vary on the size of the crew. The crew compliment of a CVN is 3,217. AOE crew sizes range from 550 for newer AOEs to 650 for older AOEs for an average of 600. The estimated cost for a CVN PCS is $10,721,000 for about 3,217 sailors. When a CVN moves to a new home port for the first time, a one-time cost due to moving families is incurred. One-time CVN PCS moves associated with each alternative and costs are listed below:

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
2CVN to NASNI 1CVN to PSNS	2CVN to NASNI	2CVN to NASNI 1CVN to PHNSY	1CVN to NASNI 1CVN to Everett	1CVN to PSNS 1CVN to PHNSY	1CVN to NASNI 1CVN to PSNS
$32,163,000	$21,442,000	$32,163,000	$21,442,000	$21,442,000	$21,442,000

PCS costs due to changing homeports for DPIA maintenance are recurring costs and are annualized for a 30-year life cycle.

Recurring CVN PCS Costs For DPIA Maintenance

Only two homeport alternative locations have CVN-capable drydocks where drydocking planned incremental availabilities (DPIAs) can be performed; PSNS and PHNSY. CVNs homeported at NASNI and NAVSTA Everett must change their homeports for each DPIA. A homeport change is necessary because the DPIA is estimated to last longer than 180 days and the Navy authorizes a change homeport so the crew can move their families to the DPIA location.

The total PCS cost for changing homeport location is estimated to be $ 10,721,000. Each DPIA requires two changes of homeport; first to the location with the drydock and return to the original homeport when the DPIA is complete. A DPIA is done once every 77 months. The costs of changing homeports during a DPIA annualize at $3,341,160 [2 changes of homeport x $10,721,000/change x (12 months/year)/77 months].

The 30-year life cycle cost for changing homeports during a DPIA is $59,212,673 per CVN. This estimate will be used for drydocking PIAs of ship's homeported at NASNI and at NAVSTA Everett.

One-time PCS Cost for AOE Homeport Change

If AOEs were to move from PSNS to NAVSTA Everett, the crews homeport would change. With two each of the older and new ship type being considered for moving, a maximum of 2,400 crew members will change homeports. The PCS cost for moving 4 AOEs from PSNS to NAVSTA Everett would be $7,998,259. This value is found using CVN costs ($10,721,000) times a ratio of crew members (2400 AOE crew/3,217 CVN crew). The PCS cost for moving 2 AOEs from PSNS to NAVSTA Everett is estimated to be $3,999,130 using a 1,200/3,217 ratio.

2.2.2.3 Cost for CVN Training at SOCAL

A CVN must train with its support ships and aircraft squadrons to demonstrate its readiness for deployment. Most CVN training is done in the Southern California (SOCAL) training area, both at sea and over land. There are transit steaming costs associated with CVN training in SOCAL. The fuel cost to steam an aircraft carrier to SOCAL used in this comparative analysis is estimated at $90,000/day. During a deployment cycle, a CVN is estimated to make 4 training and deployment round trips to the SOCAL training area.

Transit of Pacific NW CVN to SOCAL

Transit time to SOCAL from the Pacific Northwest (PSNS & NAVSTA Everett) is 3 days and a round trip is 6 days. The annualized cost for Pacific Northwest round trips is $1,350,000 (6 days/round trip x 5 round trips x $90,000/trip)/2 year deployment cycle).

The 30-year life cycle cost for CVNs homeported in the Pacific Northwest to train in SOCAL is $23,921,732 per CVN.

Transit of PHNSY CVN to SOCAL

Transit time from PHNSY to SOCAL is 6 days and around trip is 12 days. The annualized cost for PHNSY round trips is $2,700,000 (12 days/round trip x 5 round trips x $90,000/trip)/2 year deployment cycle).

The 30-year life cycle cost for a CVN homeported at PHNSY to train in SOCAL is $47,843,464 for one CVN.

2.2.2.4 Ship's Crew Commute From NAVSTA Everett to PSNS for Maintenance

The commute for the Everett CVN crew when the ship is at PSNS for PIA is over two hours. COMNAVAIRPAC and a number of Pacific Northwest entities are meeting to resolve this issue and to bring the commute time down to 1.5 hours. The contracted cost to provide ferry/bus transportation for the crew is $2.08M per PIA. Considering that two PIAs are performed every 77 months for each CVN, the annualized cost is $648,312. The 30-year life cycle cost is $11,487,954 for each NAVSTA Everett CVN.

2.3 Housing Costs

Housing costs depend on many variables: the number of crew members, their marital status, their pay grade, and if they housed on or off base.

CVN crew size is 3,217. The table below represents details for married and single CVN personnel:

Pay Grade	CVN Crew	Percent Married	Total Married	Percent Single	Total Single
E-1	N/A	N/A	N/A	N/A	N/A
E-2	N/A	N/A	N/A	N/A	N/A
E-3	1205	0.28	337.4	0.72	867.6
E-4	743	0.54	401.22	0.46	341.78
E-5	540	0.74	399.6	0.26	140.4
E-6	365	0.87	317.55	0.13	47.45
E-7	122	0.91	111.02	0.09	10.98
E-8	43	0.93	39.99	0.07	3.01
E-9	26	0.94	24.44	0.06	1.56
WO-1	N/A	N/A	N/A	N/A	N/A

Pay Grade	CVN Crew	Percent Married	Total Married	Percent Single	Total Single
WO-2	13	0.9	11.7	0.1	1.3
WO-3	5	0.93	4.65	0.07	0.35
WO-4	2	0.98	1.96	0.02	0.04
O-1	14	0.36	5.04	0.64	8.96
O-2	37	0.52	19.24	0.48	17.76
O-3	52	0.69	35.88	0.31	16.12
O-4	29	0.84	24.36	0.16	4.64
O-5	18	0.88	15.84	0.12	2.16
O-6	3	0.92	2.76	0.08	0.24

The percentage of eligible families residing in government housing varies between locations: NASNI - 18%, PSNS - 25%, NAVSTA Everett - 1.0%, and PHNSY - 65%.

Operation and maintenance costs for personnel living on base at NASNI, PSNS, and NAVSTA Everett are estimated at $7,500 per unit. For PHNSY the cost is estimated at $9,456 per unit.

2.3.1 *Family Housing Costs*

2.3.1.1 On Base Family Housing Costs

The annualized/30-year life cycle housing costs for married crew members living on base are:

Location	Annualized Cost	30-year Life Cycle Cost
NASNI	$2,366,078	$41,668,640
PSNS	$3,286,218	$58,231,131
NAVSTA Everett	$302,332	$5,357,263
PHNSY	$10,772,488	$190,886,349

2.3.1.2 Off-Base Family Housing Costs

The per unit cost for a crew member and his or her family to live off base at each location was calculated using FY98 Basic Allowance for Housing (BAH) rates for each pay grade.

The annualized/30-year life cycle housing costs for Married crew members living off base are:

Location	Annualized Cost	30-year Life Cycle Cost
NASNI	$12,635,537	$223,899,208
PSNS	$10,556,170	$187,053,237
NAVSTA Everett	$15,294,494	$271,015,398
PHNSY	$7,661,334	$135,757,317

2.3.2 *Bachelor Housing Costs*

2.3.2.1 On Base Bachelor Housing Costs

Crew members who are single and are E1 through E4 pay grade are required to live on board the ship at no housing cost per unit. For NASNI, PSNS, and PHNSY, 100% of single crew members reside in off base housing. At NAVSTA Everett, E5 and E6 rate sailors stay in on-base BEQ accommodations at $10/day or $3650/yr. This is considered to be the O&M cost for bachelor sailors on the west coast. For Everett the annual cost is $685,653 and the 30 year cost is $12,149,635.

2.3.2.2 Off-Base Bachelor Housing Costs

Single crew members of pay grade E5 may reside in the community with approval of the Commanding Officer and host base. Permanent Bachelor Enlisted Quarter rooms are only available at NAVSTA Everett, which can house single crew members through pay grade E6. For NASNI, PSNS, and PHNSY, 100% of single crew members must reside in off base housing. For NAVSTA Everett since E-5's and E-6's can be housed on base, 56 single crew members will reside in off-base housing.

The annualized/30-year life cycle housing costs for single crew members living off base are:

Location	Annualized Cost	30-year Life Cycle Cost
NASNI	$1,761,831	$31,219,296
PSNS	$1,187,995	$21,050,327
NAVSTA Everett	$556,803	$9,866,439
PHNSY	$857,712	$15,198,486

2.3.3 *AOE Housing Costs*

Housing costs for AOE crew members are base on an averaged 600 crew members per AOE and ratioed with CVN housing costs (600/3,217 x CVN Cost for location). The calculated costs of AOE housing per alternative are listed below:

Alternatives	1	2	3	4	5	6
AOE 1 & 2	$ 111,365,093	$99,342,841	$99,342,841	$99,342,841	$99,342,841	$99,342,841
AOE 3 & 4	$111,365,093	$99,342,841	$99,342,841	$99,342,841	$111,365,093	$99,342,841

3.0 COMPARING COST OF ALTERNATIVES

3.1 Comparing Construction Costs for Alternatives

The table below shows the construction costs associated with each alternative. Each project identifies in parenthesis the project location (N)=NASNI, (P)=PSNS, (E)=Everett, and (PH)=PHNSY. Each project identified with an asterisk (*) requires ongoing utility and maintenance funding. Construction costs are discussed in section 2.1.

Project	Alternative 1 $ Cost	Alternative 2 $ Cost	Alternative 3 $ Cost	Alternative 4 $ Cost	Alternative 5 $ Cost	Alternative 6 $ Cost
P-700A (N) *	54,440,000	54,440,000	54,440,000	54,440,000		
Mods to Berth L/M (N) *	1,200,000	1,200,000	1,200,000			
2nd CVN Utility Upgrades (P) *	1,900,000				1,900,000	
Parking Garage (E) *				8,000,000		
Electrical - 4160V (E) *				2,300,000		
Haz Waste Facility (E) *				1,900,000	1,900,000	
Transit Shed (E) *				5,500,000		
Steam Plant (E) *				1,500,000		
Oil Waste Tanks (E) *				920,000		
Dredge Pier A (E)				1,200,000		
Dredge, North Wharf (E)	450,000			450,000	450,000	
Utilities, North Wharf (E) *	3,375,000			3,375,000	3,375,000	
Structural Repairs (E)	550,000			550,000	550,000	
Mooring Dolphin (E)	270,000				270,000	
Electrical AOE (E) *	2,500,000				2,500,000	
Dredge (PH)			31,920,000		31,920,000	
CIF (PH) *			72,120,000		72,120,000	
Pump Test Facility (PH) *			6,500,000		6,500,000	
Pure Water (PH) *			3,000,000		3,000,000	
Utility/Structure (PH) *			7,400,000		7,400,000	
Parking Garage (PH) *			12,700,000		12,700,000	
Drydock 4 (PH) *			6,250,000		6,250,000	
Personnel Support (PH) *			6,700,000		6,700,000	
TOTAL Costs	64,685,000	55,640,000	202,230,000	80,135,000	157,535,000	0

3.2 Comparing Operational Costs for Alternatives

The table below shows the operational costs associated with each alternative. Operational costs are discussed in Section 2.2.

	Alternative 1 $ Cost	Alternative 2 $ Cost	Alternative 3 $ Cost	Alternative 4 $ Cost	Alternative 5 $ Cost	Alternative 6 $ Cost
Operations & Maintenance	22,474,024	19,718,595	60,357,188	27,619,855	44,067,374	
Utilities	3,170,750	2,782,000	8,515,500	3,896,750	6,217,250	
TDY NASNI DMF PIA	93,803,566	93,803,566	93,803,566	46,901,783		46,901,783
TDY PHNS PIA/DPIA			189,627,549		189,627,549	
PCS NASNI CVN DPIA	118,425,346	118,425,346	118,425,346	59,212,673		59,212,673
PCS Everett CVN DPIA		59,212,673		118,425,346	59,212,673	59,212,673
PCS Move CVN	32,163,000	21,442,000	32,163,000	21,442,000	21,442,000	21,442,000
PCS Move AOEs	7,998,259				3,999,130	
PACNORWEST Steaming Costs	23,921,732	23,921,732		47,843,464	47,843,464	47,843,464
Pearl Steaming Costs			47,843,464		47,843,464	
Everett x-Sound Costs		11,487,954		22,975,908	11,482,954	11,487,954
TOTAL Costs	301,592,721	350,793,866	550,735,614	348,317,779	431,740,859	246,100,547

3.3 Comparing Housing Costs for Alternatives

The table below shows the housing costs associated with each alternative. Operational costs are discussed in Section 2.3. Detailed calculation of housing cost can be found in Section 4.

	Alternative 1 $ Cost	Alternative 2 $ Cost	Alternative 3 $ Cost	Alternative 4 $ Cost	Alternative 5 $ Cost	Alternative 6 $ Cost
CVN 1	(N) 297,044,936	(N) 297,044,936	(N) 297,044,936	(N) 297,044,936	(P) 266,334,695	(N) 297,044,936
CVN 2	(N) 297,044,936	(N) 297,044,936	(N) 297,044,936	(E) 298,565,933	(E) 298,565,933	(P) 266,334,695
CVN 3	(P) 266,334,695	(E) 298,565,933	(PH) 341,842,508	(E) 298,565,933	(PH) 341,842,508	(E) 298,565,933
AOE 1 & 2	(E) 111,365,093	(P) 99,342,841	(P) 99,342,841	(P) 99,342,841	(P) 99,342,841	(P) 99,342,841
AOE 3 & 4	(E) 111,365,093	(P) 99,342,841	(P) 99,342,841	(P) 99,342,841	(E) 111,450,606	(P) 99,342,841
TOTAL Cost	1,083,154,753	1,091,341,487	1,134,618,062	1,092,862,484	1,117,451,070	1,060,631,246

3.4 Formula for Comparison

The purpose of this analysis is to compare the costs associated with each homeporting alternative to the cost of taking no action (Alternative 6). The resulting difference is how much more costly any alternative is than taking no action.

Costs of currently homeporting CVs, CVNs, and AOEs within the scope of the EIS are as follows:

	NASNI	PSNS	Everett	PHNSY
Current Homeporting Costs	2CV $	4AOE $	1CVN $	

The new costs associated with changes due to each alternative are listed below:

	NASNI	PSNS	Everett	PHNSY
Alternative 1	2CVN $	1CVN $	4AOE $	
Alternative 2	2CVN $	4AOE $	1CVN $	
Alternative 3	2CVN $	4AOE $		1CVN $
Alternative 4	1CVN $	4AOE $	2CVN $	
Alternative 5		1CVN $ 2AOE $	1CVN $ 2AOE $	1CVN $
Alternative 6	1CVN $	1CVN $ 4AOE $	1CVN $	

The formulas used to compare a zero cost of no action to the cost of the other alternative are listed below:

STATUS QUO COST = 2CV$ @NASNI + 4AOE$ @PSNS +1CVN$ @EVERETT

BASELINE = 1CVN$ @NASNI + 1CVN$ @ PSNS + 4AOE$ @PSNS + 1CVN$ @EVERETT - STATUS QUO

ALT 1 = 2CVN$ @NASNI + 1CVNS @PSNS + 4AOE$ @EVERETT - STATUS QUO - BASELINE

ALT 2 = 2CVN$ @NASNI + 4AOE$ @PSNS + 1CVN$ @EVERETT - STATUS QUO - BASELINE

ALT 3 = 2CVN$ @NASNI + 4AOE$ @PSNS + 1CVN$ @PHNSY - STATUS QUO - BASELINE

ALT 4 = 1CVN$ @NASNI + 4AOE$ @PSNS + 2CVN$ @EVERETT - STATUS QUO - BASELINE

ALT 5 = 1CVN$@ PSNS + 2AOE$ @ PSNS + 1CVN$ @EVERETT+ 2 AOE$ @EVERETT + 1CVN$ @PHNSY - STATUS QUO - BASELINE

ALT 6 = 1CVN$ @NASNI + 1CVN$ @PSNS + 4AOE$ @PSNS + 1CVN$ @EVERETT - STATUS QUO - BASELINE

Total cost of an alternative is comprised of new and old costs. The old costs (status quo) are those being incurred now for homeporting CVs, CVNs, and AOEs that are within the scope of the EIS and new costs resulting from choices associated with each alternative. The cost of the status quo is equal for all alternatives. With the no action alternative being the "zero" value cost or baseline, the cost of each alternative when compared to no action is: (New Costs - Old Costs)$_{\text{Alternatives 1-5}}$ - (New Costs - Old Cost)$_{\text{Alternative 6}}$, which become (New Costs - Status Quo) - Baseline or New Costs$_{\text{Alternatives 1-5}}$ - Status Quo - Baseline.

3.5 Comparison of Cost for Each Alternative with Cost of Taking No Action

The result from the spreadsheets for comparing the cost of each alternative to the cost of taking no action are listed below:

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
$ 143,064,637	$ 191,043,560	$ 580,851,882	$ 214,583,470	$ 399,995,135	$ 0

All alternatives are more expensive than Alternative 6, the no action alternative. But Alternative 6 poses the greatest operational challenges, such as the loss of the CVN transit berth at NASNI and severely overloading the waterfront at PSNS.

The next least expensive alternative is Alternative 1.

4.0 SPREADSHEET COMPARISON

Following this page is a spreadsheet analysis of CVN homeporting costs.

4.1 Cost Summary

Table 4-1 is a Cost Summary. The Cost Summary provides total costs for each alternative regarding construction, operation, and housing. Also given is the comparative cost between each alternative and taking no action.

4.2 Detail Costs

Table 4-2 contains the Detail Costs for the CVN Homeporting proposal. The costs for construction, operation, and housing are detailed for each of the alternatives.

4.3 Housing Costs by Homeport

Table 4-3 details the housing costs by homeport.

4.4 Footnotes to CVN Cost Alternative Tables (4-1 through 4-3)

The following footnotes apply to all three of the Cost Tables (4-1, 4-2, and 4-3)

1. The baseline of the cost summary is defined as Alternative Six, as it is the minimum additional cost necessary to maintain U.S. Pacific Fleet carrier force structure as approved by the National Command Authority, and funded by Congress. This cost is $43.2M over 30 years.

2. Status quo is defined as: 2 CVs at NASNI, 4 AOEs at PSNS, and 1 CVN at Everett. The cost of status quo is the current operations and housing cost of these ships.

3. The cost of dredging and pier construction at PSNS is not included in this cost estimate, as the cost incurred would be the same for Alternatives One through Five. The cost for these two construction projects (not including the electrical upgrade necessary to support two CVNs) is $81.5M.

4. CVs/CVNs use the same frequency between drydockings, and cost the same for change of station moves.

5. Facilities expected to incur utility or maintenance cost are noted with an "*" under the construction categories. The 2 percent operations and maintenance and the 5 percent utilities costs under operations only apply to "*" items. In other words, the Navy does not expect utilities and/or maintenance costs to be incurred by one-time expenditures or items such as dredging. Maintenance dredging is considered to be infrequent at each location considered.

6. The alternatives use the following convention when totaling cost::

   Alternative 1 = 2 CVNs at NASNI + 1 CVN at PSNS + 4 AOEs at Everett - Status Quo – Baseline

Alternative 2 = 2 CVNs at NASNI + 4 AOEs at PSNS + 1 CVN at Everett - Status Quo – Baseline

Alternative 3 = 2 CVNs at NASNI + 4 AOEs at PSNS + 1 CVN at Pearl - Status Quo – Baseline

Alternative 4 = 1 CVN at NASNI + 4 AOEs at PSNS + 2 CVNs at Everett - Status Quo – Baseline

Alternative 5 = 1 CVN at PSNS + 2 AOEs at PSNS + 1 CVN at Everett + 2 AOEs at Everett + 1 CVN at Pearl - Status Quo – Baseline

Alternative 6 = 1 CVN at NASNI + 1 CVN at PSNS + 4 AOEs at PSNS + 1 CVN at Everett - Status Quo - Baseline = 0

Status Quo = 2 CVs at NASNI + 4 AOEs at PSNS + 1 CVN at Everett

Baseline = Cost to get to No Action Alternative from Status Quo =
1 CVN at NASNI + 1 CVN at PSNS + 4 AOEs at PSNS + 1 CVN at Everett - Status Quo

7. All footnotes contained in the Final EIS apply.

8. For NAVSTA Everett, BEQ rates are $10/day. The O&M cost for NAVSTA on-base bachelors is based on this rate (i.e., 365 days* $10/day = $3600/yr). The west coast BEQs are considered to be the same rate, and Pearl Harbor ratioed at the married O&M rate or (9456/7500)*3600.

9. The negative cost under Alternative 6 for housing indicates that it is cheaper to house a CVN at PSNS than a CV at NASNI, even when considering a CV has a smaller crew.

4-1 Cost Summary

COST CATEGORY	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6
Construction SUB TOTAL	$ 64,685,000	$ 55,640,000	$ 202,230,000	$ 80,135,000	$ 157,535,000	$ -
Operations SUB TOTAL	$ 88,908,973	$ 137,746,162	$ 337,687,908	$ 135,270,074	$ 218,693,154	$ 33,052,843
Housing SUB TOTAL	$ 11,036,856	$ 17,822,694	$ 84,102,726	$ 19,572,950	$ 70,852,370	$ (7,142,947)
BASELINE (No Action Cost)						**$ 25,909,895**
LESS BASELINE	**$ (25,909,895)**	**$ (25,909,895)**	**$ (25,909,895)**	**$ (25,909,895)**	**$ (25,909,895)**	**$ (25,909,895)**
GRAND TOTAL (cost of alternative compared to Alternative 6 - No Action Alternative)	**$ 138,720,934**	**$ 185,298,960**	**$ 598,110,739**	**$ 209,068,129**	**$ 421,170,628**	**$ -**

4-2 Detail Costs
(Page 1 of 2)

COSTS FOR CVN HOMEPORT PROPOSALS

	STATUS QUO COST - OPS
ALT 1	$ 213,047,705
ALT 2	$ 213,047,705
ALT 3	$ 213,047,705
ALT 4	$ 213,047,705
ALT 5	$ 213,047,705
ALT 6	$ 213,047,705

	STATUS QUO COST - HOUSING
ALT 1	$ 1,078,033,524
ALT 2	$ 1,078,033,524
ALT 3	$ 1,078,033,524
ALT 4	$ 1,078,033,524
ALT 5	$ 1,078,033,524
ALT 6	$ 1,078,033,524

COST	CATEGORY	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6
CONSTRUCTION							
	P-700A (N) *	$ 54,440,000	$ 54,440,000	$ 54,440,000	$ 54,440,000	$ -	$ -
	Mods to Berth L/M (N) *	$ 1,200,000	$ 1,200,000	$ 1,200,000	$ -	$ -	$ -
	Second CVN Utility Upgrades (P) *	$ 1,900,000	$ -	$ -	$ -	$ 1,900,000	$ -
	Parking Garage (E) *	$ -	$ -	$ -	$ 8,000,000	$ -	$ -
	Electrical - 4160V (E) *	$ -	$ -	$ -	$ 2,300,000	$ -	$ -
	Haz Waste Facility (E) *	$ -	$ -	$ -	$ 1,900,000	$ 1,900,000	$ -
	Transit Shed (E) *	$ -	$ -	$ -	$ 5,500,000	$ -	$ -
	Steam Plant (E) *	$ -	$ -	$ -	$ 1,500,000	$ -	$ -
	Oil Waste Tanks (E) *	$ -	$ -	$ -	$ 920,000	$ -	$ -
	Dredge Pier A (E)	$ -	$ -	$ -	$ 1,200,000	$ -	$ -
	Dredge, North Wharf (E)	$ 450,000	$ -	$ -	$ 450,000	$ 450,000	$ -
	Utilities, North Wharf (E) *	$ 3,375,000	$ -	$ -	$ 3,375,000	$ 3,375,000	$ -
	Structural Repairs (E)	$ 550,000	$ -	$ -	$ 550,000	$ 550,000	$ -
	Mooring Dolphin (E)	$ 270,000	$ -	$ -	$ -	$ 270,000	$ -
	Electrical AOE (E) *	$ 2,500,000	$ -	$ -	$ -	$ 2,500,000	$ -
	Dredge (PH)	$ -	$ -	$ 31,920,000	$ -	$ 31,920,000	$ -
	CIF (PH) *	$ -	$ -	$ 72,120,000	$ -	$ 72,120,000	$ -
	Pump Test Facility (PH) *	$ -	$ -	$ 6,500,000	$ -	$ 6,500,000	$ -
	Pure Water (PH) *	$ -	$ -	$ 3,000,000	$ -	$ 3,000,000	$ -
	Utility/Structure (PH) *	$ -	$ -	$ 7,400,000	$ -	$ 7,400,000	$ -
	Parking Garage (PH) *	$ -	$ -	$ 12,700,000	$ -	$ 12,700,000	$ -
	DryDock 4 (PH) *	$ -	$ -	$ 6,250,000	$ -	$ 6,250,000	$ -
	Personnel Support (PH) *	$ -	$ -	$ 6,700,000	$ -	$ 6,700,000	$ -
	Construction SUB TOTAL	$ 64,685,000	$ 55,640,000	$ 202,230,000	$ 80,135,000	$ 157,535,000	$ -
		$ 63,415,000	$ 55,640,000	$ 170,310,000	$ 77,935,000	$ 124,345,000	$ -

4-2 Detail Costs
(Page 2 of 2)

OPERATIONS							
Operations and Maintenance	= 2% of Facility Cost* + 30 Years	$ 22,474,024	$ 19,718,595	$ 60,357,188	$ 27,619,855	$ 44,067,374	$ -
Utilities	= 5% of Facility Cost*	$ 3,170,750	$ 2,782,000	$ 8,515,500	$ 3,896,750	$ 6,217,250	$ -
TDY NASNI DMF PIA	$8,492,000/PIA or $2,646,857/yr	$ 93,803,566	$ 93,803,566	$ 93,803,566	$ 46,901,783	$ -	$ 46,901,783
TDY PHNSY PIA/DPIA	$19,243,300/PIA, $30,181,030/DPIA or $10,701,448/yr	$ -	$ -	$ 189,627,549	$ -	$ 189,627,549	$ -
PCS NASNI CVN DPIA	$10,721,000/move each way	$ 118,425,346	$ 118,425,346	$ 118,425,346	$ 59,212,673	$ -	$ 59,212,673
PCS Everett CVN DPIA	$10,721,000/move each way	$ -	$ 59,212,673	$ -	$ 118,425,346	$ 59,212,673	$ 59,212,673
PCS Move CVN	$10,721,000/move each way	$ 32,163,000	$ 21,442,000	$ 32,163,000	$ 21,442,000	$ 21,442,000	$ 21,442,000
PCS Move AOEs	= 2400/3217*$10,721,000/four AOEs	$ 7,998,259	$ -	$ -	$ -	$ 3,999,130	$ -
PACNORWEST Steaming Costs	=$90,000/day, 5 round trips, 6 days, every 2 yrs	$ 23,921,732	$ 23,921,732	$ -	$ 47,843,464	$ 47,843,464	$ 47,843,464
Pearl Steaming Costs	=$90,000/day, 5 round trips, 12 days, every 2 yrs	$ -	$ -	$ 47,843,464	$ -	$ 47,843,464	$ -
Everett x-Sound Costs	=$2.08M/PIA or $648,312/yr	$ -	$ 11,487,954	$ -	$ 22,975,909	$ 11,487,954	$ 11,487,954
	SUB TOTAL	$ 301,956,678	$ 350,793,867	$ 550,735,614	$ 348,317,779	$ 431,740,859	$ 246,100,548
	LESS STATUS QUO COST	$ (213,047,705)	$ (213,047,705)	$ (213,047,705)	$ (213,047,705)	$ (213,047,705)	$ (213,047,705)
	OPERATIONS SUB TOTAL	$ 88,908,973	$ 137,746,162	$ 337,687,908	$ 135,270,074	$ 218,693,154	$ 33,052,843
HOUSING							
	CVN 1	$ 297,044,936	$ 297,044,936	$ 297,044,936	$ 297,044,936	$ 272,079,295	$ 297,044,936
	CVN 2	$ 297,044,936	$ 297,044,936	$ 297,044,936	$ 298,795,192	$ 298,795,192	$ 272,079,295
	CVN 3	$ 272,079,295	$ 298,795,192	$ 365,075,223	$ 298,795,192	$ 365,075,223	$ 298,795,192
	AOE 1 & 2	$ 111,450,606	$ 101,485,577	$ 101,485,577	$ 101,485,577	$ 101,485,577	$ 101,485,577
	AOE 3 & 4	$ 111,450,606	$ 101,485,577	$ 101,485,577	$ 101,485,577	$ 111,450,606	$ 101,485,577
	SUB TOTAL	$ 1,089,070,380	$ 1,095,856,218	$ 1,162,136,249	$ 1,097,606,473	$ 1,148,885,893	$ 1,070,890,577
	LESS STATUS QUO COST	$ (1,078,033,524)	$ (1,078,033,524)	$ (1,078,033,524)	$ 1,078,033,524	$ (1,078,033,524)	$ (1,078,033,524)
	HOUSING SUB TOTAL	$ (11,036,856)	$ 17,822,694	$ 84,102,726	$ 19,572,950	$ 70,852,370	$ (7,142,947)
COST	CATEGORY	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6
BASELINE (No Action Cost)							$ (25,909,895)
LESS BASELINE		$ (25,909,895)	$ (25,909,895)	$ 25,909,895	$ (25,909,895)	$ (25,909,895)	$ (25,909,895)
GRAND TOTAL (cost of alternative compared to Alternative 6 - No Action Alternative)		$ 138,720,934	$ 185,298,960	$ 598,110,739	$ 209,068,129	$ 421,170,628	$ -

NOTES:	STATUS QUO COST	= 4 AOE@BREMERTON + 2CVS@NASNI+ICVN@EVERETT
	BASELINE	= 1 CVN @ NASNI + 1 CVN @ PSNS + 4 AOEs at PSNS + 1 CVN @ EVERETT - STATUS QUO
	ALT 1	= 2CVN's @ NASNI + 1 CVN @ BREMERTON + 4 AOE's @ EVERETT - STATUS QUO - BASELINE
	ALT 2	= 2CVN's @ NASNI + 1 CVN @ EVERETT + 4 AOE's @ BREMERTON - STATUS QUO - BASELINE
	ALT 3	= 2CVN's @ NASNI + 1 CVN @ PEARL HARBOR + 4 AOE's @ BREMERTON - STATUS QUO - BASELINE
	ALT 4	= ICVN @ NASNI + 2 CVN's @ EVERETT + 4 AOE's @ BREMERTON - STATUS QUO - BASELINE
	ALT 5	= ICVN @ BREMERTON + ICVN @ EVERETT + 1 CVN @ PEARL HARBOR + 2 AOE's @ BREMERTON + 2 AOE's @ EVERETT - STATUS QUO - BASELINE
	ALT 6	= ICVN @ NASNI + ICVN @ BREMERTON + ICVN @ EVERETT + 4 AOE's @ BREMERTON - STATUS QUO - BASELINE
	*	Requires ongoing utilities and maintenance funding support

4-3 Housing Costs by Home Port

BREMERTON COSTS	%	NUMBER	BAH/O&M COSTS PER UNIT *	CVN COST / YR	CVN 30 YR COST	AOE - 18.65% OF CVN 30 YR COST
MARRIED HOUSING COST						
GOVERNMENT QUARTERS	25.0%	375	$ 7,500	$ 3,286,212	$ 58,231,131	$ 10,860,106
CIVILIAN HOUSING	75.0%	1124	*	$ 10,556,170	$ 187,053,237	$ 34,885,429
SUB TOTAL		**1499**			**$ 245,284,368**	**$ 45,745,535**
BACHELOR HOUSING COST						
GOVERNMENT QUARTERS	0.0%					
CIVILIAN HOUSING	100.0%	343	*	$ 1,512,146	$ 26,794,927	$ 4,997,254
SUB TOTAL		**343**			**$ 26,794,927**	**$ 4,997,254**
TOTAL				**$ 15,354,534**	**$ 272,079,295**	**$ 50,742,789**

EVERETT COSTS	%	NUMBER	BAH/O&M COSTS PER UNIT	CVN COST / YR	CVN 30 YR COST	AOE - 18.65% OF CVN 30 YR COST
MARRIED HOUSING COST						
GOVERNMENT QUARTERS	1.0%	15	$ 7,500	$ 302,332	$ 5,357,263	$ 999,130
CIVILIAN HOUSING	99.0%	1484	*	$ 15,294,494	$ 271,015,398	$ 50,544,372
SUB TOTAL		**1499**			**$ 276,372,661**	**$ 51,543,502**
BACHELOR HOUSING COST						
GOVERNMENT QUARTERS	78.0%	269**	$ 3,650	$ 685,653	$ 12,149,635	$ 2,265,907
CIVILIAN HOUSING	22.0%	74	*	$ 579,741	$ 10,272,895	$ 1,915,895
SUB TOTAL		**343**			**$ 22,422,530**	**$ 4,181,802**
TOTAL				**$ 16,862,220**	**$ 298,795,192**	**$ 55,725,304**

SAN DIEGO COSTS	%	NUMBER	BAH/O&M COSTS PER UNIT	CVN COST / YR	CVN 30 YR COST	CV - 96.83% OF CVN 30 YR COST
MARRIED HOUSING COST						
GOVERNMENT QUARTERS	18.0%	270	$ 7,500	$ 2,366,078	$ 40,668,640	$ 7,819,280
CIVILIAN HOUSING	82.0%	1229	*	$ 12,635,537	$ 217,182,232	$ 41,757,202
SUB TOTAL		**1499**			**$ 257,850,872**	**$ 49,576,482**
BACHELOR HOUSING COST						
GOVERNMENT QUARTERS	0.0%	0				
CIVILIAN HOUSING	100.0%	343	*	$ 1,761,821	$ 30,282,717	$ 5,822,399
SUB TOTAL		**343**			**$ 30,282,717**	**$ 5,822,399**
TOTAL				**$ 16,763,446**	**$ 288,133,589**	**$ 55,398,881**

PEARL HARBOR	%	NUMBER	BAH/O&M COSTS PER UNIT	CVN COST / YR	CVN 30 YR COST
MARRIED HOUSING COST					
GOVERNMENT QUARTERS	65.0%	974	$ 9,456	$ 10,772,488	$ 190,886,349
CIVILIAN HOUSING	35.0%	525	*	$ 7,661,334	$ 135,757,317
SUB TOTAL		**1499**		**$18,433,822**	**$ 326,643,666**
BACHELOR HOUSING COST					
GOVERNMENT QUARTERS	0.0%	0	$ 4,602		
CIVILIAN HOUSING	100.0%	343	*	$ 2,168,848	$ 38,431,556
SUB TOTAL		**343**			**$ 38,431,556**
TOTAL				**$ 20,602,670**	**$ 365,075,223**

Notes: * BAH varies by paygrade and geographic location.

** Assumes all bachelor E-5 & E-6 live in BEQ.

See Table 4-3(a), San Diego CVN Annual Housing Costs, Puget Sound Naval Shipyard CVN Annual Housing Costs, Everett CVN Annual Housing Costs, and Pearl Harbor CVN Annual Housing Costs.

4.3(a) San Diego CV Annual Housing Costs

Pay Grade	Number in Pay Grade	All Navy Percent Married	All Navy Percent Bachelor	Number Married	Number Bachelor	BAH with Dependents	BAH without Dependents	Annual Cost of Living in Private Sector, Married	Annual Cost of Living in Private Sector, Bachelor	Annual Cost of Living in Gov't Quarters Married	Annual Cost of Living in Gov't Quarters Bachelor	Sum of Columns I, J,K, & L
O-6	2	0.92	0.08	1.84	0.16	1,441.85	1,193.72	26,105.56	2,291.94	2,484	0	30,881.50
O-5	18	0.88	0.12	15.84	2.16	1,363.51	1,127.76	212,524.30	29,231.54	21,384	0	263,139.84
O-4	30	0.84	0.16	25.20	4.80	1,198.07	1,041.84	297,083.02	60,009.98	34,020	0	391,113.01
O-3	50	0.69	0.31	34.50	15.50	1,016.31	856.16	345,016.92	159,245.76	46,575	0	550,837.68
O-2	21	0.52	0.48	10.92	10.08	913.84	715.03	98,194.67	86,490.03	14,742	0	199,426.70
O-1	11	0.36	0.64	3.96	7.04	790.29	582.49	30,794.76	49,208.76	5,346	0	85,349.51
WO-4	2	0.98	0.02	1.96	0.04	1,309.10	1,160.68	25,247.83	557.13	2,646	0	28,450.95
WO-3	3	0.93	0.07	2.79	0.21	1,061.53	863.29	29,142.82	2,175.49	3,766.50	0	35,084.81
WO-2	10	0.90	0.10	9.00	1	1,010.03	792.76	89,448.26	9,513.12	12,150.00	0	111,111.38
W-1	0	n/a	n/a	n/a	n/a	940.41	714.76	n/a	n/a	n/a	0	n/a
E-9	20	0.94	0.06	18.80	1.20	1,058.38	802.79	195,791.83	11,560.18	25,380	0	232,732.01
E-8	31	0.93	0.07	28.83	2.17	944.94	713.69	268,067.38	18,584.49	38,920.50	0	325,572.37
E-7	116	0.91	0.09	105.56	10.44	893.91	621.35	928,513.61	77,842.73	142,506	0	1,148,862.34
E-6	305	0.87	0.13	265.35	39.65	821.45	559.12	2,144,842.09	266,029.30	358,222.50	0	2,769,093.89
E-5	500	0.74	0.26	370.00	130	707.90	494.38	2,577,322.32	771,232.80	499,500	0	3,848,055.12
E-4	801	0.54	0.46	432.54	368.46	616.39	469	2,623,475.17	0.00	583,929	0	3,207,404.17
E-3	1,195	0.28	0.72	334.60	860.40	587	469	1,932,676.37	n/a	451,710	0	2,384,386.37
E-2	0	n/a	n/a	n/a	n/a	587	469	n/a	n/a	n/a	0	n/a
E-1	0	n/a	n/a	n/a	n/a	587	469	n/a	n/a	n/a	0	n/a
Total	**3,115**							**11,824,246.91**	**1,543,973.23**	**2,243,281.50**	**0**	**15,611,501.65**

4.3(a) San Diego CVN Annual Housing Costs

Pay Grade	Number in Pay Grade	All Navy Percent Married	All Navy Percent Bachelor	Number Married	Number Bachelor	BAH with Dependents	BAH without Dependents	Annual Cost of Living in Private Sector, Married	Annual Cost of Living in Private Sector, Bachelor	Annual Cost of Living in Gov't Quarters Married	Annual Cost of Living in Gov't Quarters Bachelor	Sum of Columns I, J,K, & L
O-6	3	0.92	0.08	2.76	0.24	1,441.85	1,193.72	39,158.34	3,437.91	3,726	0	46,322.25
O-5	18	0.88	0.12	15.84	2.16	1,363.51	1,127.76	212,524.30	29,231.54	21,384	0	263,139.84
O-4	29	0.84	0.16	24.36	4.64	1,198.07	1,041.84	287,180.25	58,009.65	32,886	0	378,075.91
O-3	52	0.69	0.31	35.88	16.12	1,016.31	856.16	358,817.60	165,615.59	48,438	0	572,871.19
O-2	37	0.52	0.48	19.24	17.76	913.84	715.03	173,009.65	152,387.19	25,974	0	351,370.84
O-1	14	0.36	0.64	5.04	8.96	790.29	582.49	39,193.33	62,629.32	6,804	0	108,626.65
WO-4	2	0.98	0.02	1.96	0.04	1,309.10	1,160.68	25,247.83	557.13	2,646	0	28,450.95
WO-3	5	0.93	0.07	4.65	0.35	1,061.53	863.29	48,571.37	3,625.82	6,277.50	0	58,474.68
WO-2	13	0.90	0.10	11.70	1.30	1,010.03	792.76	116,282.73	12,367.06	15,795	0	144,444.79
W-1	n/a	n/a	n/a	n/a	n/a	940.41	714.76	0	0	0	0	0
E-9	26	0.94	0.06	24.44	1.56	1,058.38	802.79	254,529.38	15,028.23	32,994	0	302,551.61
E-8	43	0.93	0.07	39.99	3.01	944.94	713.69	371,835.40	25,778.48	53,986.50	0	451,600.38
E-7	122	0.91	0.09	111.02	10.98	893.91	621.35	976,540.18	81,869.08	149,877	0	1,208,286.26
E-6	365	0.87	0.13	317.55	47.45	821.45	559.12	2,566,778.24	318,362.93	428,692.50	0	3,313,833.67
E-5	540	0.74	0.26	399.60	140.40	707.90	494.38	2,783,508.11	832,931.42	539,460	0	4,155,899.53
E-4	743	0.54	0.46	401.22	341.78	616.39	469	2,433,510.68	0.00	541,647	0	2,975,157.68
E-3	1,205	0.28	0.72	337.40	867.60	587	469	1,948,849.39	n/a	455,490	0	2,404,339.39
E-2	n/a	n/a	n/a	n/a	n/a	587	469	n/a	n/a		0	
E-1	n/a	n/a	n/a	n/a	n/a	587	469	n/a	n/a		0	
Total	3,217			1,752.65	1,464.35			12,635,537	1,761,831	2,366,078	0	16,763,446

4.3(a) Puget Sound Naval Shipyard CVN Annual Housing Costs

Pay Grade	Number in Pay Grade	All Navy Percent Married	All Navy Percent Bachelor	Number Married	Number Bachelor	BAH with Dependents	BAH without Dependents	Annual Cost of Living in Private Sector, Married	Annual Cost of Living in Private Sector, Bachelor	Annual Cost of Living in Gov't Quarters Married	Annual Cost of Living in Gov't Quarters Bachelor	Sum of Columns I, J,K, & L
O-6	3	0.92	0.08	2.76	0.24	1,110.64	919.51	27,588.30	1,986.14	5,175	0	34,749.44
O-5	18	0.88	0.12	15.84	2.16	1,037.70	858.27	147,934.51	16,684.77	29,700	0	194,319.28
O-4	29	0.84	0.16	24.36	4.64	981.25	853.29	215,129.25	35,633.39	45,675	0	296,437.64
O-3	52	0.69	0.31	35.88	16.12	846.49	713.09	273,348.55	103,455.10	67,275	0	444,078.65
O-2	37	0.52	0.48	19.24	17.76	750.37	587.13	129,934.07	93,846.86	36,075	0	259,855.93
O-1	14	0.36	0.64	5.04	8.96	681.21	502.09	30,899.69	40,488.54	9,450	0	80,838.22
WO-4	2	0.98	0.02	1.96	0.04	929.50	824.12	16,396.38	296.68	3,675	0	20,368.06
WO-3	5	0.93	0.07	4.65	0.35	911.21	741.04	38,134.14	2,334.28	8,718.75	0	49,187.16
WO-2	13	0.90	0.10	11.70	1.30	800.23	628.09	84,264.22	7,348.65	21,937.50	0	113,550.37
W-1	n/a	n/a	n/a	n/a	n/a	800.23	608.21	0.00	0.00	0	0	0.00
E-9	26	0.94	0.06	24.44	1.56	894.95	678.83	196,853.20	9,530.77	45,825	0	252,208.98
E-8	43	0.93	0.07	39.99	3.01	839.99	634.42	302,320.80	17,186.44	74,981.25	0	394,488.49
E-7	122	0.91	0.09	111.02	10.98	824.17	572.87	823,494.18	56,611.01	208,162.50	0	1,088,267.69
E-6	365	0.87	0.13	317.55	47.45	740.99	504.35	2,117,712.37	215,382.67	595,406.25	0	2,928,501.29
E-5	540	0.74	0.26	399.60	140.40	665.37	464.68	2,392,936.67	587,169.65	749,250	0	3,729,356.32
E-4	743	0.54	0.46	401.22	341.78	576.21	402.68	2,080,682.79	0.00	752,287.50	0	2,832,970.29
E-3	1,205	0.28	0.72	337.40	867.60	552.77	407.04	1,678,541.38	0	632,625	0	2,311,166.38
E-2	n/a	n/a	n/a	n/a	n/a	530.99	392	n/a	n/a		0	
E-1	n/a	n/a	n/a	n/a	n/a	530.99	392	n/a	n/a		0	
Total	3,217			1,752.65	1,464.35			10,556,170.49	1,187,954.95	3,286,218.00	0	15,030,343.44

4.3(a) Everett CVN Annual Housing Costs

Pay Grade	Number in Pay Grade	All Navy Percent Married	All Navy Percent Bachelor	Number Married	Number Bachelor	BAH with Dependents	BAH without Dependents	Annual Cost of Living in Private Sector, Married	Annual Cost of Living in Private Sector, Bachelor	Annual Cost of Living in Gov't Quarters Married	Annual Cost of Living in Gov't Quarters Bachelor	Sum of Columns I, J,K, & L
O-6	3	0.92	0.08	2.76	0.24	1,206.33	998.73	39,034.72	2,810.19	476.10	0	42,321.00
O-5	18	0.88	0.12	15.84	2.16	1,176.42	973.01	218,470.79	24,640.35	2,732.40	0	245,843.54
O-4	29	0.84	0.16	24.36	4.64	1,053.48	916.10	300,870.35	49,835.25	4,202.10	0	354,907.70
O-3	52	0.69	0.31	35.88	16.12	964.50	812.51	405,723.79	153,556.98	6,189.30	0	565,470.07
O-2	37	0.52	0.48	19.24	17.76	875.40	684.95	197,463.77	142,619.08	3,318.90	0	343,401.75
O-1	14	0.36	0.64	5.04	8.96	760.13	560.26	44,915.29	58,853.65	869.40	0	104,638.35
WO-4	2	0.98	0.02	1.96	0.04	1,040.54	922.57	23,910.61	432.65	338.10	0	24,681.36
WO-3	5	0.93	0.07	4.65	0.35	1,018.38	828.20	55,518.62	3,398.44	802.13	0	59,719.18
WO-2	13	0.90	0.10	11.70	1.30	902.35	708.24	123,776.07	10,794.43	2,018.25	0	136,588.75
W-1	n/a	n/a	n/a	n/a	n/a	902.35	685.83	0	0	0	0	0
E-9	26	0.94	0.06	24.44	1.56	987.60	742.28	282,981.53	13,575.89	4,215.90	0	300,773.32
E-8	43	0.93	0.07	39.99	3.01	930.14	702.52	436,089.40	24,791.40	6,898.28	0	467,779.08
E-7	122	0.91	0.09	111.02	10.98	910.78	633.07	1,185,469.86	81,494.80	19,150.95	0	1,286,115.61
E-6	365	0.87	0.13	317.55	47.45	830	546.94	3,090,053.65	0.00	54,777.38	173,192.50	3,318,023.52
E-5	540	0.74	0.26	399.60	140.40	746.22	521.15	3,495,973.84	0.00	68,931	512,460	4,077,364.84
E-4	743	0.54	0.46	401.22	341.78	638.22	476	3,002,125.15	0.00	69,210.45	0	3,071,335.60
E-3	1,205	0.28	0.72	337.40	867.60	604.73	476	2,392,116.92	0	58,201.50	0	2,450,318.42
E-2	n/a	n/a	n/a	n/a	n/a	603	476	0	0	0	0	0
E-1	n/a	n/a	n/a	n/a	n/a	603	476	0	0		0	
Total	**3,217**			**1,752.65**	**1,464.35**			**15,294,494.36**	**566,803.10**	**302,332.10**	**685,652.50**	**16,849,282.06**

4.3(a) Pearl Harbor CVN Annual Housing Costs

Pay Grade	Number in Pay Grade	All Navy Percent Married	All Navy Percent Bachelor	Number Married	Number Bachelor	BAH with Dependents	BAH without Dependents	Annual Cost of Living in Private Sector, Married	Annual Cost of Living in Private Sector, Bachelor	Annual Cost of Living in Gov't Quarters Married	Annual Cost of Living in Gov't Quarters Bachelor	Sum of Columns I, J,K, & L
O-6	3	0.92	0.08	2.76	0.24	1,616.53	1,338.34	18,738.82	1,349.05	16,964.06	0	37,051.93
O-5	18	0.88	0.12	15.84	2.16	1,590.64	1,315.61	105,822.10	11,935.21	97,358.98	0	215,116.29
O-4	29	0.84	0.16	24.36	4.64	1,479.68	1,286.73	151,389.02	25,075.79	149,726.30	0	326,191.12
O-3	52	0.69	0.31	35.88	16.12	1,291.14	1,087.68	194,569.63	73,640.29	220,532.83	0	488,742.75
O-2	37	0.52	0.48	19.24	17.76	1,175.77	919.97	95,011.62	68,622.40	118,256.74	0	281,890.76
O-1	14	0.36	0.64	5.04	8.96	1,062.90	783.42	22,499.47	29,481.66	30,977.86	0	82,958.98
WO-4	2	0.98	0.02	1.96	0.04	1,435.40	1,272.66	11,816.21	213.81	12,046.94	0	24,076.96
WO-3	5	0.93	0.07	4.65	0.35	1,335.44	1,086.05	26,081.14	1,596.49	28,580.76	0	56,258.40
WO-2	13	0.90	0.10	11.70	1.30	1,290.84	1,013.16	63,431.88	5,531.85	71,912.88	0	140,876.61
W-1	n/a	n/a	n/a	n/a	n/a	1,179.45	896.44	n/a	n/a	n/a	0	0
E-9	26	0.94	0.06	24.44	1.56	1,311.03	994.43	134,574.61	6,515.51	150,218.02	0	291,308.13
E-8	43	0.93	0.07	39.99	3.01	1,264.56	955.10	212,392.97	12,074.37	245,794.54	0	470,261.88
E-7	122	0.91	0.09	111.02	10.98	1,208.51	840.03	563,508.88	38,738.82	682,373.33	0	1,284,621.03
E-6	365	0.87	0.13	317.55	47.45	1,118.47	761.28	1,491,714.62	151,715.49	1,951,789.32	0	3,595,219.43
E-5	540	0.74	0.26	399.60	140.40	1,047.10	731.28	1,757,368.87	431,221.19	2,456,101.44	0	4,644,691.50
E-4	743	0.54	0.46	401.22	341.78	937.31	713	1,579,483.58	0.00	2,466,058.61	0	4,045,542.18
E-3	1,205	0.28	0.72	337.40	867.60	870.05	713	1,232,930.45	0	2,073,795.36	0	3,306,725.81
E-2	n/a	n/a	n/a	n/a	n/a	849.65	713	n/a	n/a		0	
E-1	n/a	n/a	n/a	n/a	n/a	840.00	713	n/a	n/a		0	
Total	**3,217**			**1,752.65**	**1,464.35**			**7,661,333.87**	**857,711.94**	**10,772,488.00**	**0**	**19,291,533.81**

Final Environmental Impact Statement for

Developing Homeporting Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet

Coronado, California • Bremerton, Washington
Everett, Washington • Pearl Harbor, Hawaii

VOLUME 3

NASNI
Supplemental Documentation

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Department of the Navy

SECTION 2

NASNI POPULATION FIGURES 1992-2005

Table 2-1. Naval Air Station North Island (NASNI) Population Figures[1] 1992 - 2005

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Employed (less CV/CVN)[2,3]	16,794	17,354	17,777	17,352	18,816	19,994	17,158	16,639	16,639	16,617	16,570	16,487	16,477	16,473
Average Deployed VS, HS, HC, HSL	-872	-872	-872	-872	-872	-872	-872	-872	-872	-872	-872	-872	-872	-872
Non-Deploying Population	15,922	16,492	16,905	16,480	17,944	19,122	16,886	15,767	15,767	15,745	15,698	15,615	15,605	15,601
Carrier Personnel in Port	3,064	4,549	2,449	4,165	3,815	3,499	3,337	3,491	3,722	3,141	3,141	3,141	3,141	3,141
DMF Loading[4]	0	0	0	0	0	0	119	149	114	150	15	15	254	240
Net Daily Population	**18,986**	**21,041**	**19,354**	**20,645**	**21,759**	**22,621**	**20,223**	**19,258**	**19,603**	**19,036**	**18,854**	**18,771**	**19,000**	**18,982**

1. Years 2000 and beyond are estimates. Assumes drop in Navy end strength as exhibited in the Navy's FY 2000 President's Budget submission for manpower appropriations. Carrier personnel in port estimate based on best information available from Navy (excepting year 2000, which is derived from classified carrier deployment schedule). Crew size was averaged between CVN and CV to most closely approximate anticipated condition.
2. Total military, civilian, and contractor personnel assigned to NASNI, and all tenant activities. (source: NAS Staff Civil Engineer)
3. Homeported carrier populations are excluded from the total employed population because their irregular presence affects the air station population significantly. These personnel are included in line 4 based upon their actual presence in port.
4. DMF loading derived from long range carrier maintenance schedule.

SECTION 3.0

CARRIER DAYS IN PORT AT NASNI

Table 3-0. Carrier Days in Port at NASNI 1975 – 1998			
Year	*One Carrier Only*	*Two Carriers Simultaneously*	*Three Carriers Simultaneously*
1975	219	36	0
1976	195	36	0
1977	191	21	0
1978	181	103	41
1979	224	84	0
1980	187	131	0
1981	148	161	0
1982	185	33	0
1983	156	59	0
1984	204	96	0
1985	169	135	11
1986	54	122	132
1987	166	28	2
1988	105	237	12
1989	156	153	28
1990	180	76	22
1991	275	48	0
1992	167	96	0
1993	121	206	0
1994	181	53	0
1995	198	145	0
1996	143	152	0
1997	252	79	0
1998	211	90	0
AVERAGE	**177.83**	**99.16**	**10.33**

SECTION 3.1

NASNI SUPPLEMENTAL TOPOGRAPHY, GEOLOGY, AND SOILS INFORMATION

SECTION 3.1
NASNI SUPPLEMENTAL TOPOGRAPHY, GEOLOGY, AND SOILS INFORMATION

With the exception of current faulting information provided by Woodward-Clyde Consultants (WCC)(1998), the following has been incorporated from DON (1995).

PROJECT SITE

The following discussion of existing geologic conditions is based on geotechnical reports prepared for the project area (WCC 1994a, 1998), a review of general geotechnical and geologic literature of the project study area, and analysis of geologic maps prepared by Kennedy (1975), Jennings (1975), and Ferrito (1993a, 1993b).

Topography

The project site is located within the coastal plain of the Peninsular Ranges Geomorphic Province. This province is generally separated into two distinct geomorphic components: the northwest-trending mountain ranges, foothills, and intervening valleys, which comprise the eastern and central portions of the province; and the coastal plain, which occupies the western portion of the province. The coastal plain consists of numerous marine and nonmarine terraces dissected by stream valleys.

The preferred alternative site is located on and adjacent to Coronado Peninsula. Topographically, the peninsula is flat with elevations ranging from sea level to 30 feet above mean seal level (MSL).

Geology

The project area is underlain by one surficial deposit consisting of artificial fill soils and one formational unit consisting of the Quaternary-age Bay Point Formation (Qbp). The Qbp is widely exposed on Coronado Island. It is composed of marine and nonmarine, poorly consolidated, fine- and medium-grained, pale brown fossiliferous or fossil-bearing sandstone. The shoreward margins of the Qbp are bound by fine- to coarse-grained beach sands. Compacted artificial fill (af) underlies portions of Coronado Island. The fill is associated primarily with the development of NASNI, Naval Amphibious Base (NAB) Coronado, and the City of Coronado.

Structure and Tectonics

Structurally, the Peninsular Ranges Province appears to be an uplifted and westward-tilted block. The eastern flank is the highest and most rugged part, with altitudes gradually decreasing toward the west. The prebatholithic rocks are completely folded and deformed. Individual rock units have a predominant northwesterly trend and are generally steeply inclined to the southwest and northeast. This persistent grain is disrupted in many areas by igneous intrusions associated with the batholith, which itself is deformed.

Tectonically, the province is transected by numerous northwest-trending slip fault zones (Jennings 1975). These fault zones subdivide the province into several subparallel fault blocks that are topographically expressed as northwest-trending mountain ranges and intervening valleys. It is believed that these faults have developed as a result of the ongoing movement of the western portion of California in a northern direction along the San Andreas fault. Earthquakes caused by movements along a section of a fault generate surface, compression, and shearing waves. These waves travel at various velocities to relatively great distances; therefore, when assessing the seismicity of a certain site, the following must be considered: a large number of potential faults, the location of potential epicenters along the faults, the magnitude of the earthquake that may be generated along each fault, and their distance from the site.

The current practice in California is to consider all known faults that fall in a 60-mile (100-km) radius around a study area. The faults and seismic events on these faults can be obtained from the Global Hypocenter Data Base maintained by the U.S. Geological Survey (USGS) National Earthquake Information Center. Computer programs are available to perform the search of seismic events within a study area and also search for significant seismic events and compute the parameters of recurrence, the maximum lateral acceleration associated with seismic events, and the probability of occurrence of these seismic events at the site.

A site-specific seismic assessment for the preferred alternative concluded that the most significant faults affecting the project site are the relatively distant San Jacinto, Elsinore, Newport-Inglewood, and San Clemente faults, and the local Rose Canyon and La Nacion fault zones (Ferrito 1993b). The San Andreas fault zone is not regarded as significant because of its distance from the study area. The fault systems with the potential to affect NASNI have been identified by this study and

Table 3.1-1. Fault Systems with the Potential to Affect NASNI

Fault	*Maximum Credible Earthquake Magnitude (Richter Scale)*
Coyote Creek	7.0
Elsinore	7.5
Imperial	7.0
La Nacion	6.8
Malibu	7.5
Newport-Inglewood (Whittier)	7.0
Palos Verdes	7.0
Pinto Mountain	7.5
Raymond Hills	7.5
Rose Canyon*	7.1
San Clemente	7.7
San Gabriel	7.7
San Jacinto	7.5
Santa Susana	6.5
Sierra Madre	6.5
South San Andreas	7.5
Superstition Mountain	7.0

Note: * Rose Canyon System includes Silver Strand, Coronado, and Spanish Bight Faults.
Source: Ferrito 1993b.

are listed in Table 3.1-1. The epicenters of known earthquakes with a magnitude of 3 or greater on the Richter Scale, and within the zone of seismic evaluation for the project site, have been identified by the computer evaluation. The fault systems closest to NASNI are described below.

The Rose Canyon fault zone is a complex system of north-to-northwest trending faults extending from within San Diego Bay to the continental shelf offshore near Carlsbad (Treiman 1984). Specifically, the onshore components of the Rose Canyon fault zone extend from Point La Jolla in the north, through Old Town, to the downtown area adjacent to San Diego Bay. The fault zone is composed of a number of fault segments. The longer segments include the Rose Canyon, Mount Soledad, and Country Club faults. The principal faults in San Diego Bay include the Silver Strand, Coronado, and Spanish Bight faults, all of which consist of onshore and offshore components.

Geologic evidence suggests that the most recent movement along the fault zone was less than 500,000 years ago. Fault displacements as recently as early Holocene times (less than 11,000 years ago) cannot be precluded; evidence of faulting has been cited through Pleistocene deposits. No large earthquakes have been associated with the Rose Canyon fault during historic times. The Spanish Bight fault, which is suspected to transect the project area, is considered active (WCC 1994b, 1998).

The Silver Strand, Coronado, and Spanish Bight faults form the western half of a north-south trending graben (a narrow area of the earth's crust that has subsided between two faults) centered on San Diego Bay. At Coronado Island, the major faults are the Spanish Bight and Coronado faults. The Spanish Bight fault transects the project study area in a north/south direction. The Coronado Bank fault zone is a northwest-trending series of faults. The Coronado Bank fault zone may be a central component of a much longer structural zone that includes the Palos Verdes fault zone to the northwest and the Agua Blanca fault zone to the southeast. Relatively small earthquakes have been associated with the Coronado Bank fault zone in the recent past.

The La Nacion fault zone is a north-northwest trending system of faults extending discontinuously from the International Border for about 17 miles to La Jolla. These faults form the eastern boundary of the San Diego Bay structural depression and generally dip steeply with west-side-down normal separation. Individual segments of the system include the La Nacion, Sweetwater, and Murphy Canyon faults.

Seismicity

The California Division of Mines and Geology (CDMG) classifies faults as either active, potentially active, or inactive, according to the Alquist-Priolo Special Studies Zone Act of 1972 (CDMG 1990). A fault that has exhibited surface displacement within the Holocene Epoch (the last 11,000 years) is defined as active by the CDMG. A fault that has exhibited surface displacement during the Pleistocene Epoch (which began about 1.6 million years ago and ended about 11,000 years ago) is defined as potentially active. A fault that has exhibited displacement prior to the Pleistocene Epoch is considered inactive.

San Diego is a highly active seismic region. The San Diego Bay area has experienced mild earthquakes in recorded history, but none have been catastrophic. In 1965, three earthquakes of magnitude 3.5 had epicenter locations in San Diego Bay east of the NAB (City of Coronado 1974). With respect to local faults and fault zones, the Rose Canyon and Coronado Bank fault zones are

Table 3.1-2. Seismic Parameters for Major Active and Potentially Active Faults Affecting NASNI					
Fault	*Distance from Fault to Project Area* [1] *(miles)*	*Maximum Credible Earthquake* [2] *(Richter Magnitude)*	ESTIMATED ACCELERATION (g) *Peak Horizontal Ground* [3]	*Repeatable High Ground* [4]	*Modified Mercalli Intensity* [5]
Elsinore	44	7.5	0.12	0.12	X-XI
San Jacinto	66	7.5	0.06	0.06	X-XI
San Andreas (creep section)	96	7.0	0.02	0.02	IX-X
Coronado Bank	12	6.75	0.32	0.21	IX-X
San Clemente	41	7.3	0.13	0.13	IX-X
Rose Canyon	onsite	7.0	0.70	0.46	IX-X
La Nacion *	7	6.8	0.43	0.28	IX-X

Notes:
1. Jennings (1975).
2. After Greensfelder (1974).
3. Seed and Idriss (1982).
4. Ploessel and Slosson (1974).
5. USGS (1980).

Repeatable high ground acceleration values are generally given as 65 percent peak ground acceleration values for sites within 20+ miles of an earthquake epicenter and approach 100 percent at greater distances.

* Considered potentially active based on criteria of the CDMG.

designated by the CDMG as active, and the La Nacion fault has been designated as potentially active. Table 3.1-2 presents the seismic parameters and distances for faults most likely to affect the project area in terms of ground shaking. The most significant credible seismic event would be an earthquake of Richter magnitude 7.0 associated with the Rose Canyon fault zone, which transects the project study area.

The Richter magnitude of earthquakes is calculated from the maximum amplitude and the time separation of the compression and shearing waves (Lindeburg 1990). The Richter magnitude is related to the energy released during the earthquake. The Richter magnitude has been found to be proportional to the logarithm of the energy released during an earthquake. Thus, a Richter 4 earthquake releases 10 times more energy than a Richter 3 earthquake, and 10 times less energy than a Richter 5 earthquake. To illustrate earthquake magnitudes, the 1989 Loma Prieta earthquake had a magnitude of 7.1, while the 1994 Northridge earthquake had a magnitude of 6.6.

The intensity of earthquakes is related to the effects of the earthquakes on structures and people, and it is qualified using the Modified Mercalli scale. An earthquake associated with the Rose Canyon fault could result in a Modified Mercalli Intensity of IX to X. Effects to structures could include destruction of masonry and wooden structures, breakage of underground pipes, and serious damage to dams, dikes, and embankments. People could be thrown to the ground and cracks could appear in the ground. The intensity of the 1994 Northridge earthquake was estimated to have a Modified Mercalli Intensity of IX to X.

Geologic Hazards

Ground acceleration is an estimation of the peak bedrock or ground motion associated with a specific earthquake event. It is expressed in terms of "g" forces, where "g" equals the acceleration due to gravity. Acceleration can be measured directly from seismic events or calculated from magnitude and fault distance data. For example, a vertical ground acceleration of 1.0 g will throw loose objects into the air. The seismic hazard most likely to be detrimental to the study area is ground shaking resulting from a large earthquake generated on either a major regional or local fault. Large earthquakes along more extensive faults (e.g., the San Andreas fault zone) can produce ground accelerations with long wavelengths and durations than smaller faults, even through the latter structures may be closer and thus generate greater peak acceleration values. The wavelength, amplitude, and duration of seismic shaking can contribute to the destructive potential of individual earthquake events.

As noted above, the most significant seismic event likely to affect the study area would be associated with an earthquake of Richter magnitude 7.0 along the Rose Canyon fault zone. The estimated peak ground acceleration that could be produced by that earthquake would be 0.70 g. Such an event would likely generate Modified Mercalli intensities of IX to X, potentially resulting in a variety of adverse effects on structures and facilities.

An additional potential geohazard could result from repeatable high ground acceleration (RHGA) at the project site. Evaluation of RHGA, which is generally used for project design purposes, involves consideration of the full extent of ground acceleration values and durations as opposed to a single high peak. It is believed that a single peak of intense motion (peak acceleration) may contribute less to cumulative damage potential than several cycles of less intense shaking (Ploessel and Slosson 1974). RHGA is generally given as 65 percent of peak acceleration values for areas within 20+ miles of an earthquake epicenter, and approaches 100 percent at greater distances, based on the more rapid attenuation of peak bedrock acceleration (Ploessel and Slosson 1974). The estimated RHGA for the project site is 0.47 g.

The Departments of the Army, the Navy, and the Air Force issued a combined technical manual (TM 5-809-10/NAVFAC P-355/AFM 88-3) setting forth criteria and requirements for the seismic design of buildings on defense installations in October 1992. Chapter 4 states that "the general objectives are approached with reference to a major level (or maximum expected level) of earthquake ground motion having a 10 percent probability of exceedence in 50 years." The recent study by the Naval Civil Engineering Laboratory (NCEL) has determined the ground acceleration with 10 percent probability of exceedence at NASNI as 0.24 g (Ferrito 1993b).

Seismically induced ground-surface rupture is defined as the physical displacement of surface deposits in response to earthquake-generated seismic waves, and generally occurs along faults. Geotechnical studies prepared by WCC in 1994 and 1998 focused on the Spanish Bight fault, which is believed to transect the project area in the vicinity of the existing quaywall and the proposed P700A. Marine geophysical surveys were performed to delineate the fault, and radiocarbon dating was performed to assess the recency of faulting. The results of these studies indicate the Spanish Bight fault is active, and fault surface rupture of approximately 0.4 feet may occur at the site during the design life (50 years) of the project. It is anticipated that horizontal movements on this order would not cause collapse of the structure. (WCC 1994c, 1998). This is somewhat consistent with Navy's design criteria that lateral spread deformations due to liquefaction of fills behind the wharves be no more than 12 inches for the major earthquake (Ferrito 1997; WCC 1998). Furthermore, the risk of loss of life due to possible collapse of the wharf would be much less than for building or transportation lifelines because of the wharf's low occupancy and lack of overhead structures (WCC 1998).

Most of California, including San Diego County, is in an area of high seismic risk. However, documented cases for fault displacement of sites subjected to earthquakes similar to the anticipated design level earthquakes are extremely limited. It is generally considered economically unfeasible to build a totally earthquake-resistant project; it is therefore possible that a large or nearby earthquake could cause damage at the site (WCC 1998).

Seismically induced soil liquefaction is a phenomenon in which loose to medium dense, saturated, predominantly granular materials increase pore pressure caused by a seismic event. The increase in pore pressure reduces the effective stress in the soil, resulting in a large-scale rearrangement of the particle matrix. Liquefaction results in loss of bearing capacity, excessive surface settlement and excessive lateral spreading, and loss of stability of sloping ground.

Soils most prone to liquefaction include saturated, loose to medium dense, primarily granular soils with little or no fines content. Fills (in particular, hydraulic fills, dredged fills) and marine sediments are usually not well consolidated and may be saturated. During strong ground motion, such soils exhibit serious lateral spreading and surface settlement. Lateral spread displacements have pulled apart or sheared shallow and deep foundations of buildings, pipelines, and other structures and utilities that transect the ground displacement zone, buckled bridges, and toppled retaining walls. Liquefaction-induced settlement has resulted in toppling and collapse of building structures. Port facilities have been particularly vulnerable because they are commonly sited on poorly consolidated natural deposits or fills that are particularly susceptible to liquefaction.

Fill soils along the shoreline of Coronado Peninsula have been constructed in large part by hydraulic filling, which provides little or no consolidation. Recent geotechnical studies have been performed to assess the liquefaction potential of the fill materials and bay mud deposits (DON 1995). The studies used an empirical correlation between in situ soil resistance and the intensity of ground shaking to assess whether the soil is susceptible to liquefaction. The Standard Penetration Test (SPT) sampler blow counts obtained from boreholes were used to evaluate in situ soil resistance. Intensity of ground shaking was estimated by taking into account the relative importance of the various acceleration peaks in a typical ground motion record.

Using the empirical correlation, the required strength (expressed as a required SPT blow count) of the soil to resist liquefaction can be estimated for a given ground acceleration. In this assessment, the design peak ground acceleration 0.47 g was used, which corresponds to the probabilistic design earthquake defined as the earthquake with 10 percent probability of nonexceedence in 100 years in accordance with NAVFAC P-355 (DON 1995). In the analysis, the blow counts obtained in boreholes were corrected to a standardized value of $(N_1)_{60}$ to take into account depth, sampler type, drill rod length, and fines content and standardized to 1 ton per square foot of overburden.

The results of these strength tests indicate that the majority of the bay mud deposits have a high potential for liquefaction, and the materials on the Bay Point Formation have a low potential for liquefaction for the design seismic event.

Seismic sea waves (tsunamis) are very long, shallow, high-velocity ocean waves usually generated by earthquakes. Most tsunamis experienced locally have been within the normal tidal range and have had few noticeable effects. The greatest recorded tsunami in San Diego Bay had a recorded height of 4.6 feet in 1960 (DON 1992). A seiche is an earthquake-induced wave occurring in a confined or embayed body of water. Overwashing (i.e., flow of water in restricted areas) of the shore protection at the project site, at approximately +11 feet MLLW, may occur during a tsunami or seiche event. This would be a rare occurrence.. Tsunamis generated by very distant offshore earthquakes have been dampened by the wide offshore continental shelf before reaching San Diego. The San Clemente fault, which shows evidence of vertical separation parallel to the coastline, could generate a tsunami at the coast (Inman and Nordstrom 1973); it would likely be manifested in the bay by a gradual upswelling of sea water. Associated currents could be strong enough to damage structures in the water or along the coastal shoreline.

Potential seiches in San Diego Bay have been estimated to have maximum heights above the still water level between 6 and 12 feet, and a natural period of 20 to 30 minutes (WCC 1994c).

Soils

The near-surface soil associations on Coronado Island were surveyed and mapped by the U.S. Soil Conservation Service (SCS) in 1973. The primary soil association within the project area is the Marina-Chesterton association. It occurs predominantly on NASNI and in the City of Coronado. The surface-soil layer is a yellow-brown, fine-to-coarse sandy loam and is moderately to excessively well drained. Beneath this surface layer is a variable subsoil layer of coarse sandy loam to gray sandy clay. An iron-silica hardpan occurs intermittently across Coronado Peninsula. Beach sands are a specific soil type within this association and are characterized by excessively drained sands and gravels. Beach sand occurs along the entire ocean side of Coronado Island. In addition, the SCS classifies a portion of the project areas as "made land," or land made of artificial fill soils.

Soils-related hazards generally include soil expansion, soil erosion, and soil settlement. According to the SCS, the Marina-Chesterton association possesses a severe erosion potential and a low expansion potential. Although the SCS does not classify soils in terms of soil settlement, the surficial soils that mantel the formational materials on the site may be subject to settlement.

Settlement of artificial fills and the underlying marine deposits along the shoreline may also represent a geological, geotechnical hazard. These fills have been placed as hydraulic fill after dredging occurred in the past to accommodate Naval surface ships. Considering the time these fills have been in place and the relatively small cohesive content, a certain amount of consolidation is likely to have taken place to date. If structures are constructed on these deposits, which exert greater loads than at present, one can expect that further, possibly extensive compression develops. Both the extent of the compression and the spatial uniformity of its development is of great importance with regard to the functional operation of structures.

References

Association of Engineering Geologists. 1973. Fault Map of California.

California Division of Mines and Geology. 1990. Fault-Rupture Zones in California. Special Publication 42.

City of Coronado 1974. City of Coronado Master Plan.

DON. 1992. Draft Feasibility Study for Future NIMITZ Class Carriers at Naval Air Station, North Island, San Diego, California.

DON. 1995. Final Environmental Impact Statement for the Development of Facilities in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier.

Ferrito, J. 1993a. Development of Procedures for Computing Site Seismicity. Naval Civil Engineering Laboratory (NCEL) Technical Note N-1855.

_____. 1993b. Seismic Hazard Analysis. Naval Civil Engineering Laboratory (NCEL) User's Guide, UG-0027.

_____. 1997. Seismic Design Criteria for Soil Liquefaction, Technical Report TR-2078-SHR, U.S. Naval Facilities Engineering Services Center, Port Hueneme, CA.

Greensfelder, R.W. 1984. Maximum Credible Rock Acceleration from Earthquakes in California. CDMG Map Sheet 23.

Inman, D.L. and Nordstrom, C.E. 1973. Beach Cliff Erosion in San Diego County, California. In: Studies on the Geology and Geologic Hazards of the Greater San Diego Area, California, Ross, A. And Dowlen, R.J., eds., San Diego Association of Geologists, pp. 125-131.

Jennings, C. W. 1985. Fault Map of California. California Division of Mines and Geology Bulletin 201.

Kennedy, M. P. 1975. Geology of the San Diego Metropolitan Area, California. California Division of Mines and Geology Bulletin 200.

Lindeburg, M.L. 1990. Seismic Design of Building Structures. Professional Publications.

National Research Council (NRC) 1985. Liquefaction of Soils during Earthquakes. Washington, D.C.: National Academy Press.

Ploessel, M.R. and Slosson, J.E. 1974. Repeatable High Ground Accelerations from Earthquakes. California Geology.

Pyke, R.M., Chan, C.K. and Seed, H.B. 1974. "Settlement and Liquefaction of Sands under Multi-directional Shaking," Report No. EERC 74-2, Earthquake Engineering Research Center, University of California, Berkeley.

Seed, H.B., Tokimatsu, K., Harder, L.F., and Chung, R.M. 1984. "The Influence of SPT Procedures in Soil Liquefaction Resistance Evaluations," Report No. UCB/EERC/84/15, Earthquake Engineering Research Center, University of California, Berkeley.

Treiman, J.A. 1984. The Rose Canyon Fault Zone, A Review and Analysis: Unpublished Report for Federal Emergency Management Agency, Cooperative Agreement EMF-83-K-0148; California Department of Conservation, Division of Mines and Geology.

U.S. Geological Survey (USGS). 1980. Procedures for Estimating Earthquake Ground Motions. Professional Paper 1114.

U.S. Soil Conservation Service (SCS). 1973. Soil Survey of San Diego County. U.S. Department of Agriculture.

Werner, S.D. and Hung, S.J. 1982. "Seismic Response of Port and Harbor Facilities," R-8122-5395, under NSF Grant No. CEE-8012337, Agbabian Associates.

Woodward-Clyde Consultants (WCC). 1994a. Geotechnical Investigation, Proposed Dredging Along Quaywall and Turning Basin (P-549), Naval Air Station, North Island, Coronado, California (Draft report). Prepared for DON Naval Facilities Engineering Command Southwest Division.

______. 1994b. Geotechnical Investigation, Proposed Aircraft Carrier Wharf (P-700), Naval Air Station, North Island, Coronado, California (Draft report). February 25. Prepared for DON Naval Facilities Engineering Command Southwest Division.

______. 1994c. Seismic Hazards Assessment Proposed NIMITZ Class Aircraft Carrier Homeporting Project, Naval Air Station, North Island, Coronado, California (Draft report). May. Prepared for DON Naval Facilities Engineering Command Southwest Division.

______. 1998. Additional Fault Hazard Investigation, CVN Berthing Wharf-Phase II (P-700A), Naval Air Station North Island, Coronado, California. Prepared for Naval Facilities Engineering Command, South Bay Area Focus Team, August.

SECTION 3.2

NASNI SUPPLEMENTAL TERRESTRIAL HYDROLOGY AND WATER QUALITY INFORMATION

SECTION 3.2
NASNI SUPPLEMENTAL TERRESTRIAL HYDROLOGY AND WATER QUALITY INFORMATION

SITE 1 — SHORELINE SEDIMENTS

The following is derived directly from DON (1997):

Site History

NASNI has been used by the U.S. Navy as an air station and maintenance facility since 1917. It consists of an airfield and several building complexes that house maintenance and cleaning operations. Large areas (approximately 1.5 sq km) of the western and northern shorelines, including portions of the existing airfield, were built on fill materials dredged from San Diego Bay during 1936 and 1940. Industrial operations at NASNI began in 1920, although significant quantities of aircraft maintenance and repair wastes were not generated until the 1940s. By 1972, an estimated 700,000 gallons of industrial wastes per year were generated by facility operations. Solid and liquid industrial and municipal wastes were disposed at a number of sites on the facility, and liquid wastes also were discharged through the stormwater system into San Diego Bay and the Pacific Ocean.

The original stormwater system consisted of ten outfalls that were used from 1917 to the early 1930s for discharge of sewage and stormwater from industrial and residential areas of the northern and eastern areas of the facility. Outfalls 1 through 16 were constructed after fill operations had been completed, and these were used until 1963 to discharge sewage and until 1972 to discharge industrial wastes and stormwater runoff directly to San Diego Bay and the Pacific Ocean. In 1963, NASNI was connected to the sewage system of the City of San Diego, and sewage was conveyed to the municipal wastewater treatment plant. In 1972, all industrial waste sources were connected to the industrial waste sewer leading to the industrial waste treatment plant on base. Presently, these outfalls discharge only stormwater runoff from NASNI.

The bulk chemical characteristics of the historical outfall effluents have not been evaluated. However, constituents of the industrial wastes generated by the Navy included organic solvents, caustics, acids, plating solutions, cyanide wastes, metals, paint and paint removal sludge, lubricating oils, and other refined petroleum products. Wastes may have contained some persistent and potentially harmful chemicals. For example, industrial wastes disposed over a 50 years at the facility contained approximately 70 tons of metals, of which an estimated 80 percent was discharged from outfalls 5 through 11 into San Diego Bay.

Ecological Risk Screening Conclusions

There is a lack of apparent pattern or consistency in individual stations that had joint occurrence of statistically higher sediment contaminant concentrations, toxicity, and bioaccumulation. Outfall stations that were significantly different from reference stations of appropriate grain size had relatively low sediment and tissue concentrations and high overall survival. These two observations argue that "hot spots" of contamination with significant ecological impact do not exist for in-bay Site 1 sediments, and the evaluation of sediments grouped by grain size was reasonable for the site. It was concluded in the ecological evaluation for outfall fine-grain and coarse-grain sediment groups that neither sediment contamination concentration, toxicity nor bioaccumulation was elevated relative to in-bay reference stations. This evaluation tempers the few significant differences observed between outfall and reference sediment chemistry and bioaccumulation results with the wider perspective of ER-L and ER-M sediment guidelines. Significantly elevated mean contaminant concentrations in outfall sediments were at or below ER-L levels. Bioaccumulation of silver, the only chemical significantly bioaccumulated, occurred at low tissue concentrations relative to other West Coast estuarine animals. Further, the tissues that had statistically elevated silver bioaccumulations were exposed to sediments with silver concentrations below the ER-L sediment quality guideline. From these results, no further action is recommended for Site 1 in-bay surface sediments.

Human Health Risk Screening Conclusions

All cancer risks associated with surficial sediments from intertidal, subtidal, and the two ocean channel areas ranged from 16.9-61.5 x 10^{-6}. Cancer risks were driven primarily by arsenic and beryllium at outfall 1,2, and the intertidal stations (particularly station 8-1), and subtidal stations (particularly station 8-5); and by PAHs at outfall 16 and subtidal stations (particularly station 3-2 on the inside of Pier Bravo). The cancer risks were within the EPA-acceptable risk range of 1 x 10^{-4} to 1 x 10^{-6}. The non-cancer hazard index value was above the threshold value of 1.0 for all four areas, ranging from 2.9 at outfall 1,2 to 8.0 at outfall 16. These exceedances were driven exclusively by a mix of metals. Other than lead at station 16-2 and antimony at station 8-1, all individual hazard indices were less than 1.0. This screening approach is very conservative (i.e., protective), however, using worst-case exposure scenarios. In particular, this assessment assumed residential exposures over 70-year lifetimes. This is obviously overly conservative for all four Site 1 areas, especially in-bay subtidal area. Had industrial criteria been applied, none of the four areas would have exceeded the threshold value for non-cancer hazard risk. Because outfall 16 had contaminant concentrations that could pose a non-cancerous hazard to residents living in the channel, a more realistic human health risk estimate is recommended for this site. No further investigations regarding human health are recommended for outfall 1,2 or in-bay outfalls 3-8.

Figure 3.2-1 depicts impacted sites at or near the project site at NASNI.

SITE 12 — BURIED GASOLINE SUPPLY PIPE LEAK AREA

The following has been derived directly from Bechtel (1996):

Site 12 was identified as the location of a major underground gasoline pipeline leak that occurred in the early 1950s. Based on interviews conducted for the IAS in 1983, a buried pipeline leaked an undetermined quantity of fuel. The leak was discovered after hydrocarbon fumes were detected, apparently resulting from the high tide in the adjacent San Diego Bay bringing product to the surface. Remediation of the site groundwater was apparently completed in the 1950s when recovery wells were installed. Groundwater was pumped into an oil/water separator, and approximately 100 to 200 gallons of gasoline per day for 4 to 5 months was recovered. Subsequent sampling investigations at the site (described below) supported the IAS conclusion that any remaining fuel contaminants had probably degraded during the 30 years prior to the IAS. Closure of Site 12, with no further response action proposed and no restriction of use, is recommended.

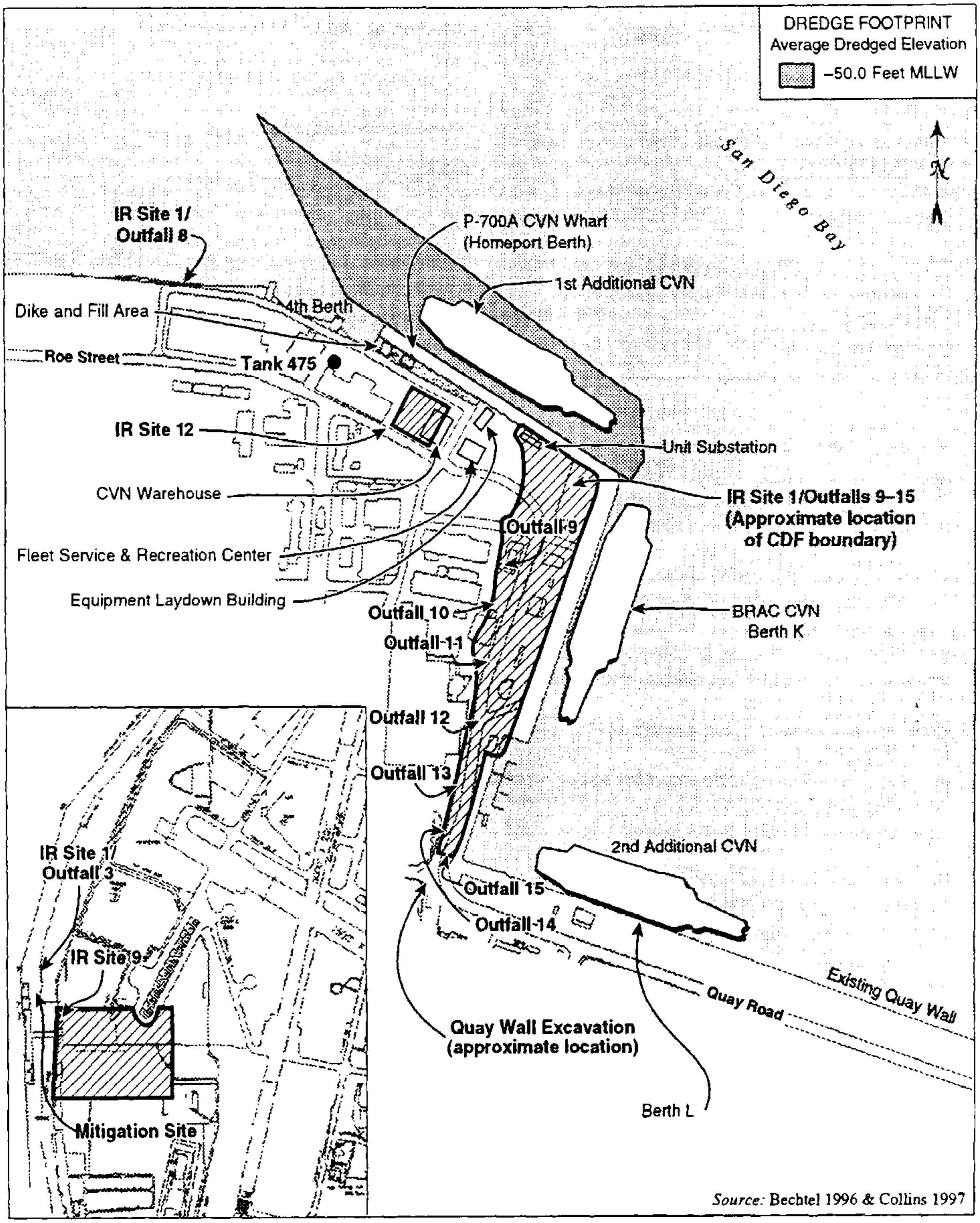

Figure 3.2-1. Impacted Sites at or near the Project Site at NASNI: IR Site 1/Outfalls 9-15, IR Site 1/Outfall 3, IR Site 1/Outfall 8, IR Site 9 and Underground Fuel Tank 475

Site Description

Site 12 is located on the east side of the north shore of NASNI. The site is currently used as a paved parking lot and is bordered on the northeast by the San Diego Bay, on the south by Roe Street, on the east by other parking areas, and on the west by Buildings M-1 and 458 (Figure 3.2-1). The surface of the surrounding area is largely covered by buildings, concrete, or pavement.

The IAS report initially identified the site as being located south of Roe Street, but a subsequent site inspection visit in 1990 revealed a fill or vent pipe for an underground storage tank (UST) and a concrete pedestal entangled in the roots of a eucalyptus tree north of Roe Street. Based on this observation and additional review of NASNI historical maps and plans, the location of Site 12 was refined. The area south of Roe Street previously contained three tanks, but the tanks did not store gasoline.

The Site 12 tank farm consisted of three aboveground 100,000-gallon gasoline tanks, one smaller (approximately 5,000- to 40,000-gallon) aboveground gasoline tank, one 17,000-gallon gasoline UST, and four 5,000-gallon USTs containing lubrication oil. Building 89, a former pump house, was located at the southern end of the tank farm.

A recent review of NASNI plans and drawings indicated that the tank farm was removed by 1957, based on the 1957 NASNI Condition Map. Underground facilities drawings indicate that the pipeline referred to in the IAS has been abandoned and at least partially removed. If recovery wells had been installed in the former tank farm, any evidence of the wells would have been obliterated during the demolition of the tank farm and construction of the present parking lot.

Nature and Extent of Contamination

Soil and groundwater samples collected from Site 12 were analyzed for fuel-related compounds, including TPH, TRPH, BTEX, and lead (organic lead in soils and total lead in groundwater). Contaminants detected in the site borings are shown on Figure 3.2-2.

Relatively low levels of TRPH (less than 50 mg/kg) were detected in perimeter soil samples, with the exception of a shallow soil sample collected at a depth of 0.5 foot in boring S12-B3 that contained 9,400 mg/kg TRPH. Only 13 mg/kg of TRPH were detected in the 2-foot sample collected in the same borehole. This anomaly was thought to be due to the asphalt paving laid in the area 6 months prior to the field investigation. Trace amounts of TRPH were detected in groundwater samples from each of the four perimeter boreholes, and low concentrations of toluene and xylenes were detected in several of the groundwater samples (Figure 3.2-2). However, these concentrations were comparable to background concentrations. Lead was not detected in any of the soil or groundwater samples.

TRPH, BTEX, and lead were not detected in soil samples collected from the Phase II boring located near the center of the site (S12-HD02), but one soil sample contained 1.1 mg/kg of TPH-diesel. Analytical results for the groundwater sample and duplicate sample are shown on Figure 3.2-2. All contaminants tested for were detected in groundwater except for toluene; however, the concentrations reported were low (2 to 21 μg/L and up to 2.3 mg/L for TRPH) and were not representative of free product. Furthermore, contaminants detected did not exceed the

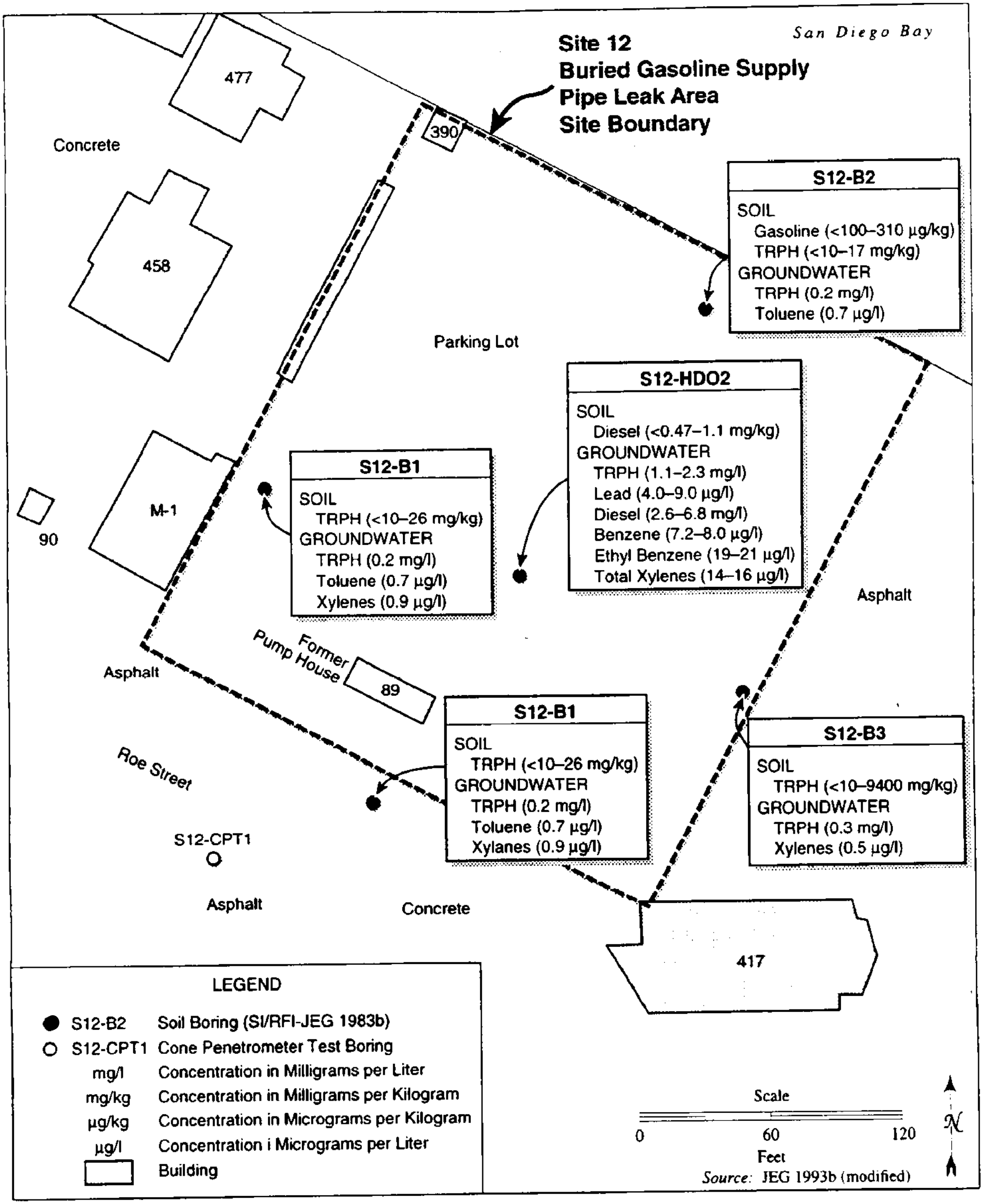

Figure 3.2-2. Site 12 — Previous Sampling Locations and Detected Contaminants, NASNI

recommended action levels for threat to bay waters. Additionally, Site 12 contaminants do not have complete exposure pathways and are not considered likely to pose a threat to human health due to the concentrations and distribution of the detected contaminants.

Site Closure Criteria

Based on the available information and site history, the DTSC concluded that there is no evidence to suggest the presence of non-fuel-related contaminants at Site 12, and that Site 12 should have been excluded from RCRA Corrective Action. In a letter dated 03 February 1995, DTSC informed the Commanding Officer of the Navy PWC of the agency's determination of no authority under RCRA Corrective Action for Site 12. This letter terminated the RCRA Corrective Action requirements and schedule of compliance for Site 12 in the state hazardous waste facility permit issued to the Navy PWC for NASNI. DTSC stated that the determination of no authority does not preclude other agencies, such as the RWQCB, San Diego Region, and/or the county of San Diego, from addressing problems at Site 12 that could threaten human health or the environment.

On 01 March 1995, a site visit/meeting was conducted at Site 12. The meeting was attended by Mr. Charles Cheng of RWQCB, San Diego Region, Mr. William Collins and Ms. Kimberly Wheeler of SWDIV, and Mr. James Kozakowski of BNI. The site history and results of previous investigations were reviewed. All participants of the meeting concurred that the data collected from the five SI/RFI sampling locations should constitute an adequate evaluation of the presence of trace contamination. Mr. Cheng expressed the opinion that the site should be closed based on this historical reevaluation and on the work performed to date.

Summary and Conclusions

Based on a review of the best available data, closure of Site 12 was recommended, with no further response action proposed for the site and no restriction of use. Closure at this site was the subject of a meeting held on 01 March 1995 between the Navy, the RWQCB, DTSC, and BNI. At that time, data from previous investigations were reviewed, and site closure was proposed. There was oral concurrence, and a letter from SWDIV requesting closure with NFRAP status was subsequently sent to RWQCB on 22 March 1995. San Diego County was copied on the letter. A letter was issued by the RWQCB, San Diego Region, on 13 February 1996 announcing that no further action would be required at Site 12.

References

Bechtel National, Inc. 1996. Preliminary Final ESI/RFI/RSE Report, Clean II Program, North Island, San Diego, California. March.

DON. 1997. Draft RI/RFI Report-Site 1 Shoreline Sediments, NAS North Island, January.

SECTION 3.4

NASNI SUPPLEMENTAL SEDIMENT QUALITY INFORMATION

SECTION 3.4
NASNI SUPPLEMENTAL SEDIMENT QUALITY INFORMATION

Tables 3.4-1 through 3.4-12 summarize quality of sediment samples collected at Naval Air Station North Island.

Table 3.4-1. Screening Study - Sediment Chemistry (in dry weight) - CVN Homeporting Project

Analyte[a]	Units	I-17	I-19	O-9	O-11	O-25	O-26	O-30	O-34	GUIDELINE VALUES NOAA ER-L	NOAA ER-M
Percent Moisture	%	23.8	17.1	22	25.3	28.0	25.5	18.5	26.4	--	--
Ammonia	mg/kg	7.0	7.3	5.8	2.5	6.7	4.5	2.5	6.6	--	--
Petroleum Hydrocarbons (TRPH)	mg/kg	130	24	100	25	130	190	16	200	--	--
Sulfide	mg/kg	4.8	2.6	4.2	7.1	30	38.3	0.86	30	--	--
Dissolved Sulfide	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	--
Total Organic Carbon	%	0.34	0.18	0.87	0.16	0.63	0.76	0.11	0.76	--	--
Silver	mg/kg	<0.10	<0.10	0.29	0.10	0.27	0.26	<0.10	0.12	1	3.7
Arsenic	mg/kg	1.4	0.8	2.5	3.4	3.8	3.8	2.0	2.3	8.2	70
Cadmium	mg/kg	0.59	<0.10	0.16	<0.10	0.12	0.29	<0.10	0.23	1.2	9.6
Chromium	mg/kg	16.4	10.5	12.7	9.8	13.9	16.2	10.3	15.9	81	370
Copper	mg/kg	11.5	5.7	18.7	7.6	26.5	27.3	5.5	22.3	34	270
Mercury	mg/kg	0.131	0.016	0.158	0.059	0.190	0.221	0.019	0.152	0.15	0.7
Nickel	mg/kg	2.85	2.05	3.44	3.89	3.42	4.06	4.07	4.08	21	52
Lead	mg/kg	11.7	3.5	13.0	4.0	23.0	23.4	4.8	15.1	47	218
Selenium	mg/kg	<0.1*s	<0.1*s	<0.2*s	<0.3*s	<0.3*s	<0.2*s	<0.2*s	<0.2*s	--	--
Zinc	mg/kg	33.8	13.4	43.8	23.1	56.1	61.9	22.3	50.1	150	410
Monobutyltin	µg/kg	<1.0	<1.0	<1.0	<1.0	11	4	<1.0	4	--	--
Dibutyltin	µg/kg	38	12	55	8	57	75	5	61	--	--
Tributyltin	µg/kg	35	63	57	59	45	55	53	42	--	--
Benzene	mg/kg	<0.033	<0.030	<0.032	<0.033	<0.035	<0.034	<0.031	<0.034	--	--
Toluene	mg/kg	<0.033	<0.030	<0.032	<0.033	<0.035	<0.034	<0.031	<0.034	--	--
Chloroform	mg/kg	<0.013	<0.0120	<0.013	<0.013	<0.014	<0.013	<0.012	<0.014	--	--
Methylene Chloride	mg/kg	0.028*L	0.064*L	0.05*L	0.035*L	0.031*L	0.021*L	0.017*L	0.023*L	--	--
Other Semivolatiles[b]	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	--	--
Total Phenols	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	--	--
Total PAHs	mg/kg	0.574	0.396	0.553	0.457	1.723	0.786	0.396	0.587	4.022	44.792
Total PCBs	mg/kg	ND	1.313	ND	ND	ND	ND	ND	ND	0.0227	0.18
Total Pesticides	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	--	--
Halomethanes[c]	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	--	--

Notes:
a. When analytes were detected, totals include measured values plus one-half of the detection limit of nondetected analytes.
b. Other Semivolatiles = 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, Hexachlorobenzene
c. Halomethanes = Bromoform, Bromomethane, Chloromethane, Chlorodibromomethane, Dichlorobromomethane
*s = Reported value was determined by method of standard additions
ND =Value less than detection limit
*L = Analyte is a suspected lab contaminant
ER-L = Effects Range - Low
ER-M = Effects Range - Median

Table 3.4-2. Grain Size and General Chemistry Characteristics at Pier J/K and Pier Bravo Sediments				
Analyte	*Detection Limit*	*Pier J/K-NW*	*Pier J/K-SE*	*Pier Bravo*
Sand (%)	NA	66.9	58.3	86.2
Silt (%)	NA	17.7	23.2	7.2
Clay (%)	NA	15.3	18.2	6.3
Gravel (%)	NA	0.16	0.38	0.29
Solids (%)	1 %	63.3	56.2	71.9
TOC (%)	0.01 %	0.770/0.832(1)	0.919/0.878(1)	0.643
Nitrogen (%)	0.01 %	0.063/0.064(1)	0.077/0.075(1)	0.054
Sulfides, Total (mg/kg)	1 mg/kg	95	107/123	46
Sulfides, Dissolved (mg/L)	1 mg/L	ND	ND	ND

NA – not applicable; (1) replicate values

Table 3.4-3. Concentrations of Trace Metals (mg/kg) in Pier J/K and Pier Bravo Sediments				
Analyte	*Detection Limit*	*Pier J/K-NW*	*Pier J/K-SE(1)*	*Pier Bravo*
Cadmium	0.05 mg/kg	0.36	0.47/0.46	0.17
Chromium	0.05 mg/kg	28.58	38.05/38.19	23.16
Copper	0.05 mg/kg	43.82	53.82/55.57	14.07
Lead	0.05 mg/kg	24.88	23.24/23.18	8.23
Mercury	0.01 mg/kg	0.19	0.21/0.22	0.12
Nickel	0.05 mg/kg	7.41	12.45/12.84	5.28
Selenium	0.05 mg/kg	0.30	0.23/0.21	0.17
Silver	0.01 mg/kg	0.58	0.55/0.55	0.13
Zinc	005 mg/kg	93.62	105.37/109.34	38.26
Arsenic	0.05 mg/kg	3.61	5.93/6.02	6.58
Aluminum	10 mg/kg	16,000	24,300/24,900	9880
Iron	10 mg/kg	15,600	25,300/26,000	10,600
Antimony	0.05 mg/kg	0.35	0.40/0.41	0.25
Beryllium	0.05 mg/kg	0.27	0.40/0.38	0.16
Manganese	0.05 mg/kg	131	212/216	108
Molybdenum	0.05 mg/kg	0.49	0.64/0.64	0.30
Tin (Total)	0.05 mg/kg	2.87	3.49/3.42	1.06
Cobalt	0.05 mg/kg	3.84	6.76/6.95	2.59
Vanadium	0.05 mg/kg	34.49	53.26/54.00	24.20

(1) replicate values

Table 3.4-4. Organotin Concentrations (□g/kg) in Pier J/K and Pier Bravo Sediments				
Analyte	*Detection Limit*	*Pier J/K-NW*	*Pier J/K-SE*	*Pier Bravo*
Monobutyltin	1.0 µg/kg	ND	ND	ND
Dibutyltin	1.0 µg/kg	ND	ND	ND
Tributyltin	1.0 µg/kg	ND	ND	ND
Tetrabutyltin	1.0 µg/kg	1.5	ND	2.2

ND – not detected

Table 3.2-5. Concentrations of Polycyclic Aromatic Hydrocarbons (µg/kg) and Total Recoverable Petroleum Hydrocarbons (mg/kg) in Pier J/K and Pier Bravo Sediments				
Analyte	*Detection Limit*	*Pier J/K-NW(1)*	*Pier J/K-SE*	*Pier Bravo*
Naphthalene*	10 µg/kg	<9/48	42	ND
1-Methylnaphthalene	10 µg/kg	ND/ND	23	ND
2-Methylnaphthalene	10 µg/kg	ND/14	48	ND
2,6-Dimethylnaphthalene	10 µg/kg	ND/ND	38	ND
2,3,5-Trimethylnaphthalene	10 µg/kg	ND/ND	ND	ND
1-Methylphenanthrene	10 µg/kg	20/16	86	ND
Acenaphthene*	10 µg/kg	ND/14	141	ND
Acenaphthylene*	10 µg/kg	36/41	22	ND
Anthracene*	10 µg/kg	55/98	290	59
Benz(a)anthracene*	10 µg/kg	123/129	292	94
Benzo(a)pyrene*	10 µg/kg	210/241	186	96
Benzo(e)pyrene	10 µg/kg	211/216	147	86
Benzo(b)fluoranthene*	10 µg/kg	306/338	228	135
Benzo(k)fluoranthene*	10 µg/kg	300/341	241	144
Benzo(g,h,i)perylene*	10 µg/kg	134/153	112	33
Biphenyl	10 µg/kg	ND/ND	24	ND
Chrysene*	10 µg/kg	230/197	258	173
Dibenz(a,h)anthracene*	10 µg/kg	51/44	19	ND
Fluoranthene*	10 µg/kg	132/186	800	206
Fluorene*	10 µg/kg	ND/24	181	19
Perylene*	10 µg/kg	48/74	34	ND
Phenanthrene*	10 µg/kg	55/121	789	106
Pyrene*	10 µg/kg	174/229	634	206
Total PAHs* (mg/kg)	NA	1.86/2.49	4.27	1.27
TRPH (mg/kg)	50 mg/kg	12,100/20,100	8100	9200

* - sum of 16 PAHs; ND – not detected; (1) replicate values

Table 3.4-6. Concentrations of Pesticides and Polychlorinated Biphenyls (µg/kg) in Pier J/K and Pier Bravo Sediments				
Analyte	*Detection Limit*	*Pier J/K-NW*[1]	*Pier J/K-SE*	*Pier Bravo*
2,4'-DDD	1 µg/kg	ND/ ND	ND	ND
2,4'-DDE	1 µg/kg	ND/ ND	ND	ND
2,4'-DDT	1 µg/kg	ND/ ND	ND	ND
4,4'-DDD	1 µg/kg	8/ ND	ND	ND
4,4'-DDE	1 µg/kg	10/10	9	9
4,4'-DDT	1 µg/kg	ND/ ND	ND	ND
Aldrin	2 µg/kg	7/11	13	7
BHC-alpha	2 µg/kg	ND/ ND	ND	ND
BHC-beta	2 µg/kg	ND/ ND	ND	ND
BHC-delta	2 µg/kg	ND/ ND	ND	ND
BHC-gamma	2 µg/kg	13/ ND	13	ND
Chlordane-alpha	1 µg/kg	ND/ ND	ND	ND
Chlordane-gamma	1 µg/kg	ND/ ND	ND	ND
Dieldrin	1 µg/kg	ND/ ND	ND	ND
Endosulfan Sulfate	2 µg/kg	ND/ ND	ND	ND
Endosulfan-I	5 µg/kg	ND/ ND	ND	ND
Endosulfan-II	5 µg/kg	ND/ ND	ND	ND
Endrin	5 µg/kg	ND/ ND	ND	ND
Endrin Aldephyde	10 µg/kg	ND/ ND	ND	ND
Heptachlor	2 µg/kg	ND/ ND	ND	ND
Heptachlor Epoxide	2 µg/kg	ND/ ND	ND	ND
Methoxychlor	5 µg/kg	ND/ ND	ND	ND
Toxaphene	10 µg/kg	ND/ ND	ND	ND
Aroclor 1016	10 µg/kg	ND/ ND	ND	ND
Aroclor 1221	10 µg/kg	ND/ ND	ND	ND
Aroclor 1232	10 µg/kg	ND/ ND	ND	ND
Aroclor 1242	10 µg/kg	ND/ ND	ND	ND
Aroclor 1248	10 µg/kg	ND/ ND	ND	ND
Aroclor 1254	10 µg/kg	50/59	42	ND
Aroclor 1260	10 µg/kg	ND/ ND	ND	ND

ND – not detected; (1) replicate values

Table 3.4-7. Concentrations of Phthalates and Phenols (µg/kg) in Pier J/K and Pier Bravo Sediments				
Analyte	*Detection Limit*	*Pier J/K-NW*[1]	*Pier J/K-SE*	*Pier Bravo*
Phthalates:				
Bis(2-ethylhexyl)	10 µg/kg	124/165	124	84
Butylbenzyl	10 µg/kg	ND/ND	ND	ND
Di-n-octyl	10 µg/kg	ND/ND	ND	ND
Dibutyl	10 µg/kg	20/18	16	16
Diethyl	10 µg/kg	ND/ND	ND	ND
Dimethyl	10 µg/kg	ND/ND	ND	ND
Phenols:				
2,4,6-Trichloro	100 µg/kg	ND/ ND	ND	ND
2,4-Dichloro	100 µg/kg	ND/ ND	ND	ND
2,4-Dimethyl	100 µg/kg	13/ ND	13	ND
2,4-Dinitro	250 µg/kg	ND/ ND	ND	ND
2-Chloro	100 µg/kg	ND/ ND	ND	ND
2-Methyl-4,6-dinitro	500 µg/kg	ND/ ND	ND	ND
2-Nitro	100 µg/kg	ND/ ND	ND	ND
4-Chloro-3-methyl	100 µg/kg	ND/ ND	ND	ND
4-Nitro	250 µg/kg	ND/ ND	ND	ND
Pentachloro	250 µg/kg	ND/ ND	ND	ND
Phenol	100 µg/kg	ND/ ND	ND	ND

ND – not detected; (1) replicate values

Table 3.4-8. Grain Size and Chemical Characteristics of Pier Bravo Soil Samples
(Page 1 of 2)

ANALYTICAL RESULTS SAMPLE LOCATION								
Analysis/Analyte		*Boring # Sample# Depth*	*EMP2-01 1 Comp.*	*EMP2-02 1 Comp.*	*EMP2-03 1 Comp.*	*Trip Blank EMP2-04*	*NOAA ER-L*	*NOAA ER-M*
EPA 413.2								
Oil & Grease	mg/kg		ND	ND	ND	-----		
EPA 418.1								
Total Petroleum Hydrocarbons	mg/kg		ND	ND	ND	-----		
EPA 8260								
Volatiles	μg/kg		ND	ND	ND	ND		
EPA 8270								
Semivolatiles & PAHs*	μg/kg		ND	ND	ND	-----	4.022*	44.792*
EPA 8080								
Pesticides	μg/kg		ND	ND	ND	-----		
EPA 8080								
PCBs	μg/kg		ND	ND	ND	-----	0.0227	0.18
Phenols	mg/kg		ND	ND	ND	-----		
Total Organic Carbon	%		0.71	0.88	0.50	-----		
CA Title 22 Metals								
Antimony	mg/kg		ND	ND	ND	-----		
Arsenic	mg/kg		ND	ND	2.10	-----	8.2	70.0
Barium	mg/kg		30.00	21.00	29.00	-----		
Beryllium	mg/kg		ND	ND	ND	-----		
Cadmium	mg/kg		ND	ND	ND	-----	1.2	9.6
Chromium, Total	mg/kg		ND	ND	ND	-----	81	370
Cobalt	mg/kg		ND	ND	ND	-----		
Copper	mg/kg		ND	ND	ND	-----	34.0	270.0
Lead	mg/kg		ND	ND	ND	-----	46.7	218.0
Mercury	mg/kg		ND	ND	ND	-----	0.15	0.71
Molybdenum	mg/kg		ND	ND	ND	-----		
Nickel	mg/kg		ND	ND	ND	-----	20.9	51.6
Selenium	mg/kg		ND	ND	ND	-----	-----	-----
Silver	mg/kg		ND	ND	ND	-----	1.0	3.7
Thallium	mg/kg		ND	ND	ND	-----		
Vanadium	mg/kg		15.00	14.00	17.00	-----		
Zinc	mg/kg		18.00	ND	17.00	-----	150	410

Table 3.4-8. Grain Size and Chemical Characteristics of Pier Bravo Soil Samples (Page 2 of 2)								
ANALYTICAL RESULTS SAMPLE LOCATION								
Analysis/Analyte		*Boring # Sample# Depth*	*EMP2-01 1 Comp.*	*EMP2-02 1 Comp.*	*EMP2-03 1 Comp.*	*Trip Blank EMP2-04*	*NOAA ER-L*	*NOAA ER-M*
Monobutyltin	µg/kg		ND	ND	ND	~~~~		
Dibutyltin	µg/kg		ND	ND	ND	~~~~		
Tributyltin	µg/kg		ND	ND	ND	~~~~		
Tetrabutyltin	µg/kg		ND	ND	ND	~~~~		
Ammonia	mg/kg		1.60	2.10	1.40	~~~~		
Sulfides	mg/kg		ND	ND	ND	~~~~		
Percent Moisture	%		21.10	18.60	16.30			
Grain Size Distribution								
Sand & Gravel	%		96.1	96.3	95.9			
Silt	%		3.4	3.4	3.3			
Clay	%		0.5	0.3	0.8			

~~~~ - Not Analyzed

ND - Not Detected at Limits Specified in Lab Reports

* - values for PAHs only
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Table 3.4-9. Summary of Soil Sample Analytical Results

Naval Air Station North Island, CVN Berthing Wharf - Phase II (P-700A)
(All constituents listed in mg/kg, unless otherwise noted)

Boring Number	Boring Location	Sample No.	Depth (m)	pH[a]	TPH[b]			VOCs[c]	Tetrabutyltin[d]	Title 22 Metals[e]													
					(C_{25}-C_{28})	(C_{29}-C_{32})	(C_{33}-C_{36})			Antimony	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Selenium	Thallium	Vanadium	Zinc
B-13	Offshore	B13-1-2	0.3	8.08	<10	<10	<10	ND	<0.001	<6.0	28.2	<0.6	2.4	17.8	3.5	19.5	9.0	<0.25	4.4	<8.0	<8.0	23.0	53.4
		B13-2-2	2.2	8.14	<10	<10	<10	NA	<0.001	<6.0	12.4	<0.6	<1.5	6.0	<2.5	<2.5	<6.0	<0.25	<2.5	<8.0	<8.0	12.0	8.1
B-14	Offshore	B14-2-2	1.6	7.87	<10	<10	<10	ND	<0.001	<6.0	76.6	3.1	4.4	22.7	8.7	14.0	<6.0	<0.25	8.4	<8.0	<8.0	49.6	41.6
B-16	Offshore	B16-1-2	0.3	8.25	<10	<10	<10	ND	0.0025/0.0012[f]	<6.0	21.0	<0.6	2.4	18.4	3.0	13.4	17.6	<0.25	3.8	<8.0	<8.0	19.0	44.0
		B16-2-2	2.0	7.79	<10	<10	<10	NA	<0.001	<6.0	<10.0	<0.6	<1.5	5.6	<2.5	<2.5	<6.0	<0.25	<2.5	<8.0	<8.0	8.7	6.4
		B16-3-2	3.2	8.07	<10	<10	<10	NA	<0.001	<6.0	<10.0	<0.6	<1.5	4.6	<2.5	<2.5	<6.0	<0.25	<2.5	<8.0	<8.0	6.8	4.8
B-18	Offshore	B18-1-2	0.3	8.02	<10	<10	<10	ND	<0.001	<6.0	49.0	<0.6	4.4	37.3	5.5	36.4	15.0	0.42	8.3	10.0	<8.0	33.5	91.6
		B18-2-2	1.8	8.99	<10	<10	<10	NA	<0.001	<6.0	62.4	<0.6	5.0	29.0	8.6	10.0	<6.0	<0.25	8.2	<8.0	<8.0	51.7	39.3
B-20	Offshore	B20-1-2	0.4	8.38	<10	<10	<10	ND	0.0013	<6.0	14.7	<0.6	<1.5	11.3	<2.5	45.8	32.0	<0.25	4.4	<8.0	<8.0	10.8	101.8
		B20-2-2	1.7	8.43	<10	<10	<10	NA	<0.001	<6.0	<10.0	<0.6	<1.5	<2.5	<2.5	<2.5	<6.0	<0.25	<2.5	<8.0	<8.0	3.6	3.5
		B20-3-2	3.7	8.39	<10	<10	<10	NA	<0.001	<6.0	<10.0	<0.6	<1.5	3.0	<2.5	<2.5	<6.0	<0.25	<2.5	<8.0	<8.0	5.0	4.4
B-21	Offshore	21-1	0.7	7.99	<10	<10	<10	NA	0.007	<6.0	47.4	<0.6	5.3	38.5	9.4	71.7	31.0	0.69	8.1	<8.0	8.8	33.4	149.0
		21-2	2.4	7.84	<10	<10	<10	NA	0.015	<6.0	49.7	<0.6	6.3	42.0	9.7	53.2	30.2	<0.25	7.6	<8.0	15.8	36.7	123.0
B-24	Offshore	24-1	0.8	7.92	<10	<10	<10	NA	<0.001	<6.0	<10.0	<0.6	<1.5	15.1	2.6	3.3	<6.0	<0.25	5.5	<8.0	<8.0	4.7	24.8
		24-2	1.8	8.19	<10	<10	<10	NA	<0.001	<6.0	<10.0	<0.6	<1.5	6.5	2.6	9.2	<6.0	<0.25	<2.5	<8.0	<8.0	8.5	13.1
B-26	Wharf	B-26-1-1	1.0	8.85	<10	<10	<10	NA	<0.001	8.5	33.5	<0.6	4.0	23.2	<2.5	48.2	20.4	<0.25	6.2	<8.0	<8.0	21.5	99.9
B-28	Wharf	B-28-1	1.1	8.54	<10	<10	<10	NA	<1.0	<6.0	42.7	<0.6	4.4	24.4	4.4	79.8	27.2	<0.25	8.0	<8.0	9.3	27.5	126
		B-28-2	3.5	9.13	<10	<10	<10	NA	<1.0	<6.0	33.9	<0.6	5.4	18.6	<2.5	28.9	19.8	<0.25	5.6	<8.0	<8.0	23.2	71.5
STLC[g]				NE	NE	NE	NE	NE	NE	15	100	0.75	1	5	80	25	5	0.2	20	1	7	24	250
TTLC[h]				NE	NE	NE	NE	NE	NE	200	10,000	75	100	2,500	8,000	2,500	1,000	20	2,000	1,000	700	2,400	5,000
ERL[i]				NE	NE	NE	NE	NE	NE	2	NE	NE	1.2	81	NE	34	46.7	0.15	20.9	NE	NE	NE	150
ERM[j]				NE	NE	NE	NE	NE	NE	25	NE	NE	9.6	370	NE	270	218	0.71	51.6	NE	NE	NE	410

Source: Data from Woodward-Clyde Consultants.

Notes

a pH by EPA Method 9045B
b Total petroleum hydrocarbons by Modified EPA Method 8015, extended range (carbon range c_7-c_{36}), with detected carbon range indicated
c Volatile organic compounds by EPA Method 8260; no VOCs were detected at the detection limits specified on the laboratory data sheets
d Organotin species by GC-FPD; tributyltin, dibutyltin and monobutyltin were not detected at the detection limits specified on the laboratory data sheets
e Title 22 metals by EPA Methods 6010 and 7471
f Duplicate sample result as indicated on the laboratory data sheets
g Soluble threshold limit concentration for determining waste characteristics
h Total threshold limit concentration for determining waste characteristics
i Effects range-low (lower 10th percentile); from Long et al. 1995
j Effects range-median (50th percentile); from Long et al. 1995
ND Not detected at the detection limits specified on the laboratory data sheets
NA Not analyzed
NE None established

Table 3.4-10. Summary of Studies, Station Locations, and Sediment Grain Size in the Vi

Study	*Site No.*	*Latitude*	*Longtitude*	*Depth*	*Date Sampled*	*% Sand*	*% Silt*
Fairey et al., 1996	93188	32, 42.68N	117, 11.35W	3	5/26/93	ND	ND
	90016	32, 42.50N	117, 11.04W	13.5	10/27/92	ND	ND
DON 1998*	Pier J/K-NW; Site 1	32, 42.788N	117, 11.441W	3	6/10/98	66.9	17.7
	Pier J/K-NW; Site 2	32, 42.799N	117, 11.461W	3	6/10/98		
	Pier J/K-SE; Site 1	32, 42.753N	117, 11.365W	7.6	6/10/98	58.3	23.2
	Pier J/K-SE; Site 2	32, 42.729N	117, 11.332W	7.6	6/10/98		
DON 1995	I-1	1711077.5	200344.87			ND	ND
	I-2	1711387	200085			ND	ND
	I-3	1711676	199833			ND	ND
	I-4	1711977.4	199561.1			ND	ND
	O-1	1709814.96	201483			66.5	16.5
	O-3	1710329.46	200982.26			63	23.3
Woodward-Clyde	13	201650	1709560			ND	ND
	14	201500	1710015			ND	ND
	16	201000	1710595			ND	ND
	18	200500	1711950			ND	ND
	20	199900	1711750			ND	ND
	21	200350	1710750			ND	ND
	24	200700	1711000			ND	ND
	26	200220	1710750			ND	ND

ND = no data
* = sites 1 and 2 from each location composited into single sample
% Survival data for DON 1995 are for surface and subsurface samples

Table 3.4-11. Concentrations of Metals in Sediments (mg/kg) from the Vicinity of Pier J/K																
Study	*Site No.*	*Aluminum*	*Antimony*	*Arsenic*	*Cadmium*	*Chromium*	*Copper*	*Iron*	*Lead*	*Manganese*	*Mercury*	*Nickel*	*Selenium*	*Silver*	*Tin*	*Zinc*
	ER-L	NE	NE	8.2	1.2	81	34	NE	46.7	NE	0.15	20.9	NE	1	NE	150
	ER-M	NE	NE	70	9.6	370	270	NE	218	NE	0.71	51.6	NE	3.7	NE	410
	STLC	NE	15	NE	1	5	25	NE	5	NE	0.2	20	1	NE	NE	250
	TTLC	NE	200	NE	100	2500	2500	NE	1000	NE	20	2000	1000	NE	NE	5000
Fairey et al., 1996	93188	54,700	0.842	7.47	0.28	64.3	84.9	30,100	33.1	331	0.327	14.2	0.25	0.947	7.47	174
	90016	46,000	0.79	8	0.16	59	47	25,000	28.2	380	0.774	24	0.2	1.48	6.46	220
DON, 1998	Pier J/K-NW; Site 1/2	16,000	0.35	3.61	0.36	28.6	43.8	15,600	24.9	131	0.19	7.41	0.3	0.58	2.87	93.6
	Pier J/K-SE; Site 1/2	24,300	0.4	5.93	0.47	38	53.8	25,300	23.2	212	0.21	12.4	0.23	0.55	3.49	105
DON, 1995	0-9	ND	ND	2.5	0.16	12.7	18.7	ND	13	ND	0.158	3.44	<0.2	0.29	ND	43.8
WWC, 1998	13, 1 ft	ND	<6.0	ND	2.4	17.8	19.5	ND	9.0	ND	<0.25	4.4	<8.0	ND	ND	53.4
	13, 7.2 ft	ND	<6.0	ND	<1.5	6.0	<2.5	ND	<6.0	ND	<0.25	<2.5	<8.0	ND	ND	8.1
	14, 5.2 ft	ND	<6.0	ND	4.4	22.7	14.0	ND	<6.0	ND	<0.25	8.4	<8.0	ND	ND	41.6
	16, 1 ft	ND	<6.0	ND	2.4	18.4	13.4	ND	17.6	ND	<0.25	3.8	<8.0	ND	ND	44.0
	16, 6.6 ft	ND	<6.0	ND	<1.5	5.6	<2.5	ND	<6.0	ND	<0.25	<2.5	<8.0	ND	ND	6.4
	16, 10 ft	ND	<6.0	ND	<1.5	4.6	<2.5	ND	<6.0	ND	<0.25	<2.5	<8.0	ND	ND	4.8
	18, 1 ft	ND	<6.0	ND	4.4	37.3	36.4	ND	15.0	ND	0.42	8.3	10.0	ND	ND	91.6
	18, 5.9 ft	ND	<6.0	ND	5	29.0	10.0	ND	<6.0	ND	<0.25	8.2	<8.0	ND	ND	39.3
	20, 1 ft	ND	<6.0	ND	<1.5	11.3	45.8	ND	32.0	ND	<0.25	4.4	<8.0	ND	ND	101.8
	20, 5.6 ft	ND	<6.0	ND	<1.5	<2.5	<2.5	ND	<6.0	ND	<0.25	<2.5	<8.0	ND	ND	3.5
	20, 12 ft	ND	<6.0	ND	<1.5	3.0	<2.5	ND	<6.0	ND	<0.25	<2.5	<8.0	ND	ND	4.4
	21, 2.3 ft	ND	<6.0	ND	5.3	38.5	71.7	ND	31.0	ND	0.69	8.1	<8.0	ND	ND	149.0
	21, 7.9 ft	ND	<6.0	ND	6.3	42.0	53.2	ND	30.2	ND	<0.25	7.6	<8.0	ND	ND	123.0
	24, 2.6 ft	ND	<6.0	ND	<1.5	15.1	3.3	ND	<6.0	ND	<0.25	5.5	<8.0	ND	ND	24.8
	24, 5.9 ft	ND	<6.0	ND	<1.5	6.5	9.2	ND	<6.0	ND	<0.25	<2.5	<8.0	ND	ND	13.1
	26, 3 ft	ND	8.5	ND	4	23.2	48.2	ND	20.4	ND	<0.25	6.2	<8.0	ND	ND	99.9
	28, 3.6 ft	ND	<6.0	ND	4.4	24.4	79.8	ND	27.2	ND	<0.25	8.0	<8.0	ND	ND	126
	28, 11 ft	ND	<6.0	ND	5.4	18.6	28.9	ND	19.8	ND	<0.25	5.6	<8.0	ND	ND	71.5
NRad, unpublished	8-1	43,100	52.63	16.7	0.39	23.2	165	19300	79.7	283	0.018	5.9	0.22	0.13	24.94	87
	8-2	63,200	1.78	4	0.13	18	17.1	14800	13.9	387	0.038	3.8	0.22	0.11	10.9	81
	8-3	69,700	0.5	2.6	0.15	20.4	15.1	15300	13.5	356	0.052	4.3	0.2	0.11	1.39	55
	8-4	78,100	0.53	4.8	0.43	45.9	56.9	26600	29.9	400	0.282	11.1	0.2	0.52	4.03	131
	8-5	85,200	1.18	9.4	0.85	73.3	97.4	41900	48	525	0.543	18.1	<0.3	0.87	6.8	220
	8-2, 1-2 ft	61300	1.11	3	0.25	21.6	10.9	12100	13.6	299	0.028	4.1	<0.3	0.08	1.43	54
	8-3, 1-2 ft	66900	0.31	2.2	0.41	24.7	4.4	11300	9.3	263	0.011	3.4	<0.3	0.03	0.6	30
	8-2, 2-3 ft	56200	0.36	1.4	0.72	16.6	7.1	11900	14.9	304	0.092	4	<0.3	0.09	1.1	31
	8-3, 2-3 ft	61700	0.31	2.5	0.15	25.3	4.7	16400	8.5	499	0.007	3.6	<0.3	0.03	0.8	32
	8-3, 3-4 ft	59800	0.34	2.7	0.14	18.4	3.8	18500	9.7	562	0.009	3.6	<0.3	0.02	0.93	33
	8-3, 4-5 ft	63700	0.28	2.4	0.15	18.7	4.9	15100	8.7	436	0.016	4.4	<0.3	0.04	1.16	33
	8-3, 5-6 ft	61600	0.2	2.4	0.17	14.8	-3.8	13900	7.8	396	0.007	3.7	<0.3	0.02	0.78	29

* ER-L = Effects Range - Low and ER-M = Effects Range - Median; Values are from Long et al. (1995). STLC = Soluble Threshold Limit Concentration for Determining Waste Characteristics; TTLC = Total Threshold Limit Concentration for Determining Waste Characteristics
ND = No Data; NE = No value Established

Table 3.4-12. Concentrations of Total PAHs, PCBs, and DDT in Sediments (mg/kg) from the Vicinity of Pier J/K				
Study	*Site No.*	*Total PAHs*	*Total PCBs*	*Total DDT*
	ER-L	4.022	0.0227	0.00158
	ER-M	44.79	0.18	0.0461
Fairey et al., 1996	93188	2.83	0.0456	0.00278
	90016	0.994	0.0206	0.0012
DON 1998	Pier J/K-NW; Site 1/2	2.36	0.05	0.018
	Pier J/K-SE; Site 1/2	4.34	0.042	0.009
DON 1995	O-9	0.553	nd	nd
NRad, unpublished	8-1	0.033	0.0042	0.00043
	8-2	0.163	0.0053	0.00063
	8-3	0.0668	0.0244	0.00029
	8-4	0.788	0.0222	0.0023
	8-5	2.118	0.0432	0.0057
	8-2, 1-2 ft	0.117	0.0094	0.001
	8-2, 2-3 ft	0.05	0.0018	0.00004
	8-3, 1-2 ft	0.021	0.002	0.00043
	8-3, 2-3 ft	0.022	0.0023	0.00011
	8-3, 3-4 ft	0.021	0.00098	0.00014
	8-3, 4-5 ft	0.029	0.0017	0.00016
	8-3, 5-6 ft	0.0168	0.00023	<0.00037
* ER-L = Effects Range - Low and ER-M = Effects Range - Median; Values are from Long et al. (1995).				

SECTION 3.5

NASNI SUPPLEMENTAL MARINE BIOLOGY INFORMATION

Table 3.5-1. Total Abundance for the Fish Species Collected in San Diego Bay, July 1995-April 1996 (page 1 of 2)

Common Name	Scientific Name	STATION ABUNDANCE: North Bay (including near project site)	STATION ABUNDANCE: North-Central Bay	Total Abundance (Bay-Wide)
Northern anchovy	*Engraulis mordax*	46,678	8,619	57,855
Topsmelt	*Atherinops affinis*	12,785	26,991	47,328
Slough anchovy	*Anchoa delicatissima*	3	5,501	19,107
Shiner surfperch	*Cymatogaster agreggata*	1,499	483	3,550
Pacific sardine	*Sardinops sagax*	1,280	1,045	2,661
Giant kelpfish	*Heterostichus rostratus*	558	792	1,899
Bay pipefish	*Syngnathus leptorhynchus*	160	406	1,161
Barred pipefish	*Syngnathus auliscus*	156	90	717
Barred sand bass	*Paralabrax nebulifer*	72	292	522
Arrow goby	*Clevlania ios*	14	151	501
Round stingray	*Urolophus halleri*	58	131	444
Deepbody anchovy	*Anchoa compressa*	0	210	286
Spotted sand bass	*Paralabrax maxulatofasciatus*	25	99	249
California halibut	*Paralichthys californicus*	59	21	149
Black surfperch	*Embiotica jacksoni*	134	1	135
California halfbeak	*Hyporhamphus rosae*	3	0	74
Shadow goby	*Quietula ycauda*	3	28	61
Dwarf surfperch	*Micrometrus minimus*	51	2	53
Queenfish	*Seriphus politus*	52	0	52
Spotted turbot	*Pleuronichthys ritteri*	25	12	41
Bay blenny	*Hypsoblennius gentilis*	19	20	40
Cheekspot goby	*Ilypnus gilberti*	1	4	38
Diamond turbot	*Hypsopsetta guttulata*	13	9	37
Black croaker	*Cheiltrema saturnum*	5	7	32
Kelp pipefish	*Syngnathus californiensis*	8	6	29
California killifish	*Fundulus parvipinnis*	0	5	27
Yellowfin croaker	*Umbrina roncador*	0	0	25
Senorita	*Oxyjulis californica*	19	0	19
Spotted kelpfish	*Gibbonsia elegans*	8	5	17
Longjaw mudsucker	*Gillichthys mirabilis*	0	0	16
Jacksmelt	*Atherinopsis californiensis*	1	1	14
Yellowfin goby	*Acanthogobius flavimanus*	0	1	11
Barcheek pipefish	*Syngnathus exilis*	0	0	11
California lizardfish	*Sunodus lucioceps*	11	0	11
Bat ray	*Myliobatis californica*	0	0	9
Kelp bass	*Paralabrax clathratus*	8	1	9
California scorpionfish	*Scorpaena guttata*	8	1	9
Salema	*Xenistius californiensis*	0	5	8
Rock wrasse	*Halichoeres semicinctus*	7	0	7
Fantail sole	*Xystreurys liolepis*	6	1	7
California tonguefish	*Symphurus atricauda*	5	1	6
Chub mackerel	*Scomber japonicus*	0	5	5
California needlefish	*Strongylura exilis*	0	3	5

Table 3.5-1. Total Abundance for the Fish Species Collected in San Diego Bay, July 1995-April 1996 (page 2 of 2)

Common Name	Scientific Name	STATION ABUNDANCE: North Bay (including near project site)	North-Central Bay	Total Abundance (Bay-Wide)
Specklefin midshipman	*Porichthys myriaster*	0	1	4
Staghorn sculpin	*Leptocottus armatus*	2	1	3
Striped mullet	*Mugil cephalus*	0	0	3
Spotfin croaker	*Roncador stearnsii*	0	0	3
White croaker	*Genyonemus lineatus*	2	0	2
Crevice kelpfish	*Gibbonsia montereyensis*	0	0	2
Opaleye	*Girella nigricans*	2	0	2
Pacific seahorse	*Hippocampus ingens*	0	2	2
White surfperch	*Phanerodon furcatus*	2	0	2
Bonefish	*Albula vulpes*	0	0	1
Speckled sanddab	*Citharichthys stigmaeus*	1	0	1
Shortfin corvina	*Cynoscion parvipinnis*	0	0	1
Striped kelpfish	*Gibbonsia metzi*	0	1	1
Grey smoothhound	*Mustelus californicus*	0	1	1
Brown smoothhound	*Mustelus henlei*	0	0	1
CO turbot	*Pleuronicthys coenosus*	1	0	1
Shovelnose guitarfish	*Rhinobatis productus*	0	0	1
Snubnose pipefish	*Bryx arctos*	0	0	1
Total		**63,744**	**44,955**	**137,269**

Source: Allen (1996).

Table 3.5-2. The 25 Most Abundant Waterbird Species Observed in North and Central San Diego Bay, 1993

NORTH SAN DIEGO BAY (NEAR PROJECT SITE)			CENTRAL SAN DIEGO BAY		
Rank	*Species*	*Total Count*	*Rank*	*Species*	*Total Count*
1	Heerman's gull	15,402	1	Surf scoter	19,651
2	Brandt's cormorant	12,672	2	Scaup species	2,300
3	California brown pelican	12,020	3	California brown pelican	1,108
4	Surf scoter	5,185	4	Bufflehead	1,042
5	Bufflehead	5,104	5	Heerman's gull	778
6	Western grebe	3,636	6	Eared grebe	713
7	Elegant tern	3,550	7	Mallard	600
8	Scaup species	2,993	8	California least tern	568
9	Double-crested cormorant	2,461	9	Forster's tern	536
10	Mallard	2,440	10	Elegant tern	438
11	Great blue heron	2,214	11	Brandt's cormorant	351
12	Forster's tern	1,994	12	Double-crested cormorant	265
13	Snowy egret	1,811	13	Western grebe	182
14	California least tern	920	14	Great blue heron	150
15	Eared grebe	795	15	Brant	77
16	Great egret	740	16	American coot	73
17	Red-breasted merganser	395	17	Snowy egret	61
18	Bonaparte's gull	353	18	Royal tern	51
19	Black-crowned night heron	328	19	Red-breasted merganser	50
20	Common loon	312	20	Common loon	47
21	Caspian tern	175	21	Great egret	35
22	Clark's grebe	145	22	Caspian tern	23
23	American coot	134	23	Bonaparte's gull	19
24	Red-throated loon	127	24	Black skimmer	16
25	Pied-billed grebe	126	25	Pied-billed grebe	16
	Total Birds Observed	**132,426**		**Total Birds Observed**	**76,138**

Source: Ogden (1995).

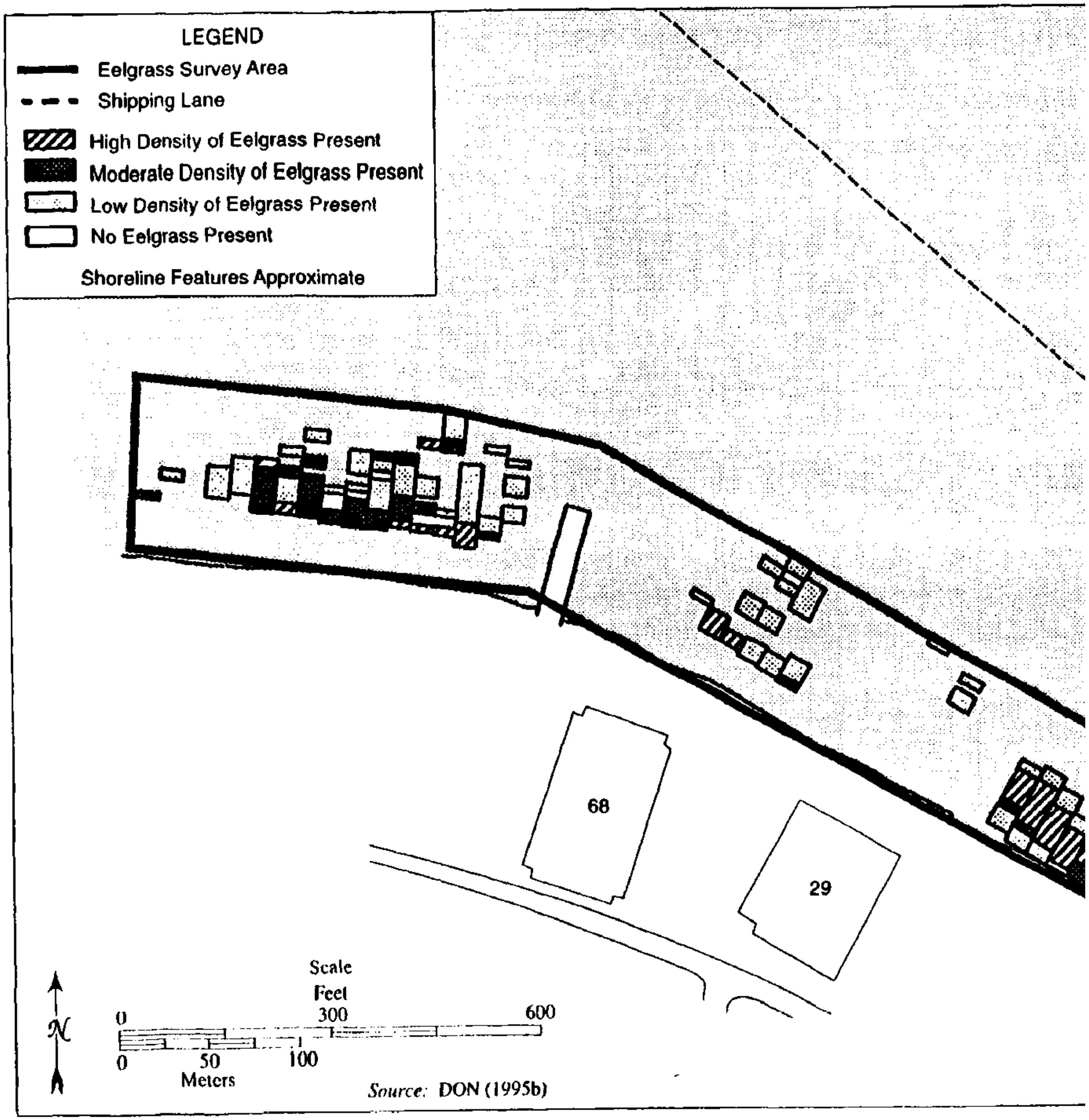

Figure 3.5-1. Detailed Eelgrass Distribution and Density North of the Project Site

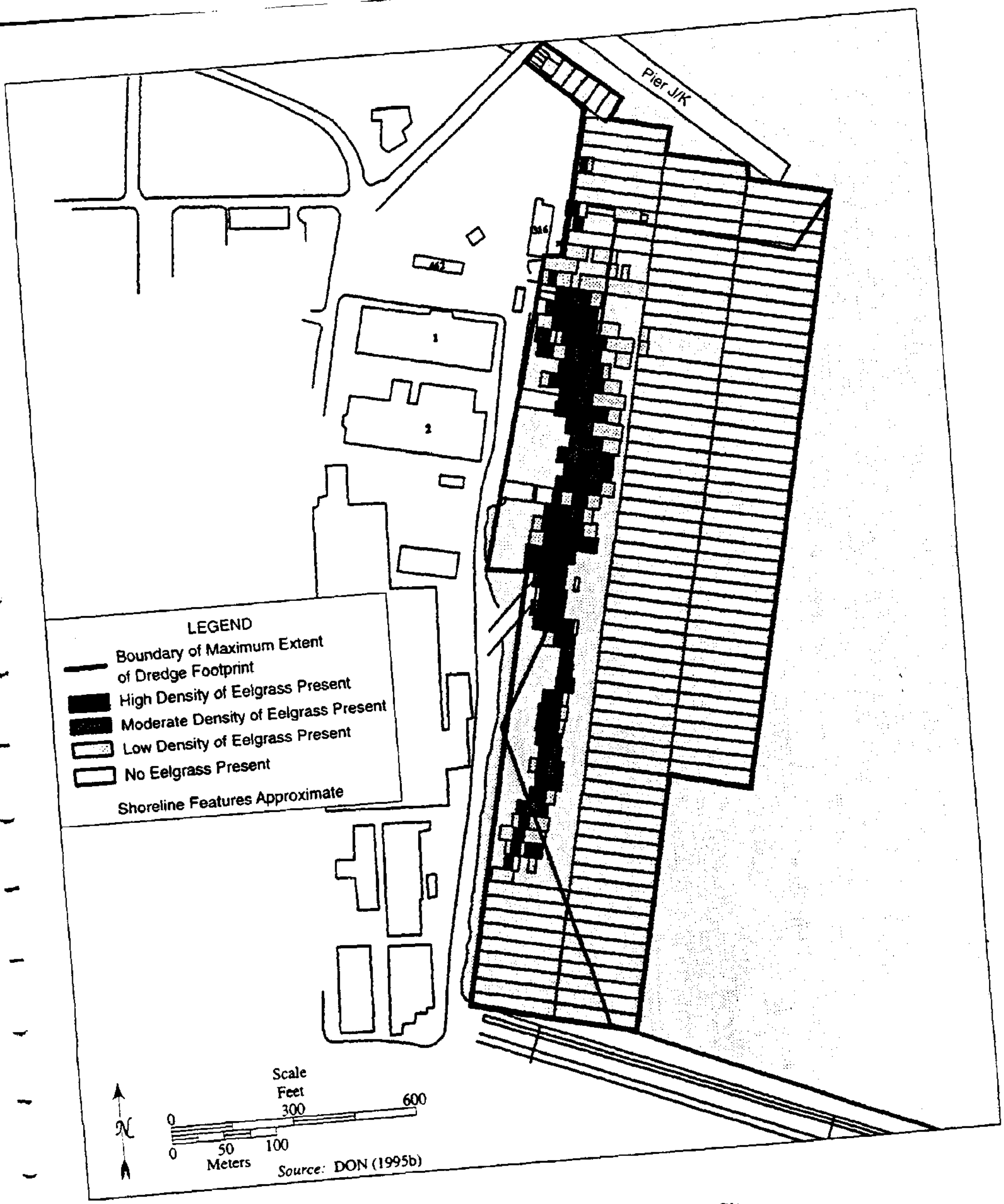

Figure 3.5-2. Detailed Eelgrass Distribution and Density East of the Project Site

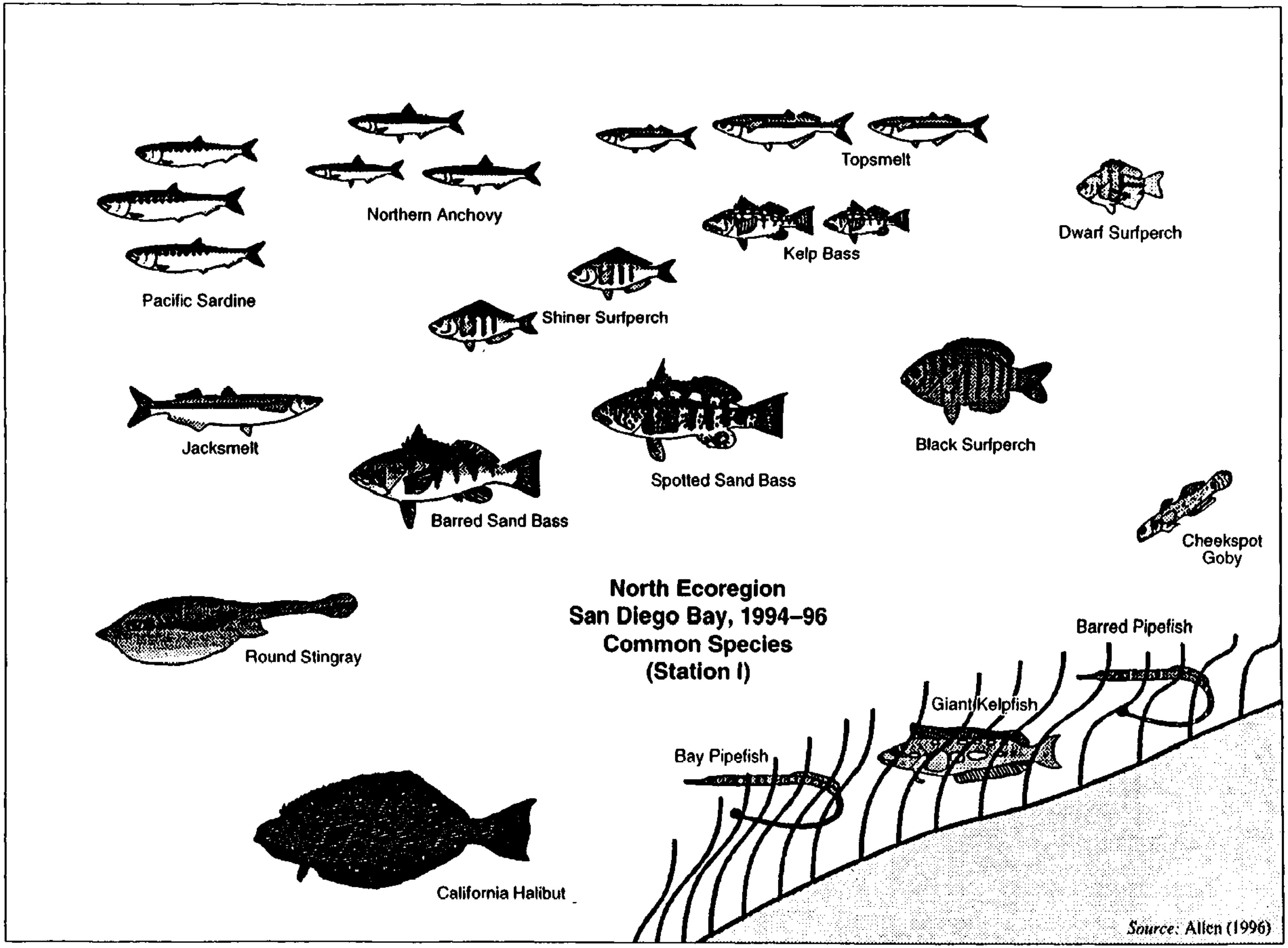

Figure 3.5-3. Common Fish Species in North San Diego Bay (Station 1), 1994–1996. Sampling locations are near project site.

MARINE BIOLOGICAL RECONNAISSANCE FIELD SURVEY REPORT

MILCON P-700A and PIER BRAVO

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December 1997

Introduction

As part of U.S Navy Contract No. N68711-97-C-8106, a biological reconnaissance survey was conducted to characterize the marine communities potentially impacted by proposed MILCON P-700A and at a proposed mitigation site near Pier Bravo. Both sites are located at Naval Air Station North Island (NASNI) in San Diego Bay, CA. This survey and the following survey report fulfill the specifications of Item 1.1 Biology, as addressed in the Modification of Work, Comprehensive Environmental Impact Statement for Aircraft Carriers, Homeporting within Pacific Fleets United States Assets.

Methods

The Pier J/K project area, including the proposed access dredging channel leading from Pier J/K, and the potential mitigation site at Pier Bravo were surveyed between November 18 and 21, 1997. The biological resources at the two sites were documented by a team of divers/biologists consisting of Danny Heilprin from Science Applications International Corporation (SAIC), and David James and Brian Riley from MEC Analytical Systems, Inc.(MEC). One of the MEC divers served as a backup/safety diver. Survey operations were conducted from the vessel Matadora (20 foot length), owned and operated by MEC. The diving was conducted according to the survey and dive plans, which were approved by SAIC prior to the survey. Karen Green served as the MEC Project Manager.

The survey consisted of a quantitative assessment of fish, epifaunal macroinvertebrates, and eelgrass. Transects were established along shore (at specified depths) and perpendicular to shore (across depths) at both the Pier J/K and Pier Bravo areas (Figure 1). In addition, transects were established along the channel axis of the proposed access dredging channel near Pier J/K (herein referred to as the Navigational Channel). The start and/or end points of transects were marked with pop buoys and their locations recorded with differential Global Positioning System (DGPS), which has an accuracy of plus/minus 6 to15 feet (ft) (2 to 5 meters (m)). In cases where only one DGPS position (start or end point) was taken in the field for a transect (e.g., access problem), the position of the other end of the transect was computed based on transect length and orientation relative to the mapped grid of transects.

At Pier J/K, two 400-ft (122-m) transects oriented along shore in the proposed fill area and three100-ft (30.5-m) transects oriented perpendicular to shore were surveyed northwest of the pier. One 400-ft (122-m) transect oriented along shore was established southeast of the pier. In the Navigational Channel, three transects were oriented along the main axis of the channel. Two of the transects were approximately 400 ft (122 m) long, while the one furthest from Pier J/K was approximately 250 ft (76 m) long. At Pier Bravo, two 400-ft (122-m) transects were surveyed along shore as well as three 35-ft (11-m) transects perpendicular to shore. The perpendicular (cross-depth) transects were shorter at Pier Bravo corresponding to the range of project depths planned for this site.

The survey was conducted under favorable weather conditions mainly between daylight hours of 0800 and 1600. Skies were clear and sunny except November 20th, which was partly cloudy. Seas generally were calm and underwater visibility averaged 6 ft (2 m) each day. On November 20th, seas became choppy in the afternoon. Dives were conducted across flood and ebb stages of the tides. Tidal fluctuations during the diving period ranged from about +6 to +3.5 mean lower low water (MLLW) on the 18th, and from +5 to +3 MLLW on subsequent days. Water depths recorded in the field were corrected to MLLW using the Micronautics Tides1 Rise and Fall computer program (U.S. West Coast).

A volumetric band (6.5 ft wide by 6.5 ft high (2 m wide by 2 m high)), centered along each transect, was censused for fish over the entire transect length. Fish were identified and counted along the bottom and in the water column up to 6.5 ft (2 m) above the transect. Fish were field identified to the lowest practicable taxon (usually species). Fish observed in the area, but outside the band transect, were noted as present.

Epifaunal macroinvertebrates were counted in a 3.3 ft^2 (1 m^2) quadrat that was randomly placed every 20 ft (6 m) along each transect, with a total of five quadrats censused per 100 ft (30.5 m) of transect length. Macroinvertebrates were identified to the lowest practicable taxon (usually species). Representative specimens of species that were not identifiable in the field were brought back to the laboratory for identification. In those cases, the unidentified specimens were given a unique identifier in the field so that accurate counts of the taxon were made. Any unique macroinvertebrates encountered along the transect, but not counted in the quadrats, were noted as present.

The occurrence of eelgrass and its relative density were surveyed on each transect. The distance at which eelgrass began and ended along a transect (within a 1 m^2 band centered on the transect) was noted and the eelgrass was characterized as relatively dense or patchy in distribution. Eelgrass turion density within 0.8 ft^2 (0.25 m^2) quadrats was recorded. A total of five quadrats were randomly placed and counted within each eelgrass bed type (i.e., dense, patchy) with a maximum of 10 quadrats counted for each transect, where possible. Fewer quadrats were counted when eelgrass was sparse or absent. Epiphytes (e.g., anemones, bryozoans) growing on eelgrass blades were noted according to relative percent cover categories (i.e., > 50%, <50%).

Results

Biological resources are summarized below according to survey site. Figures and tables are presented at the end of the report. Raw data follow in appendices with fish in Appendix A, macroinvertebrates in Appendix B, and eelgrass in Appendix C. Latitude and longitude for each transect are reported in NAD83 (North American Datum 1983) coordinates in Appendix D. In addition, the times at which the transects were surveyed, field measured water depths, and depths relative to MLLW are presented in Appendix D.

Pier J/K Vicinity

The northwest side of Pier J/K has a concrete wall at the shore, and the bay bottom was sandy mud near shore and silty mud further offshore. The two along shore transects were at shallow (Transect 2, 0 ft MLLW) and deeper depths (Transect 1, -7 to -12 ft MLLW). The three cross-depth transects were surveyed from shore to -10, - 12, and -14 ft MLLW (Transects 3 through 5, respectively). The southeast side of the pier had rock rip rap along the shore. The rocks extended offshore with the spacing between them increasing with increasing depth. The bottom was silty mud with scattered rocks at the depth (-10 ft MLLW) of the southeast transect (Transect 6). Many of the rocks were covered with a layer of silt.

A total of 9 species of fish were observed at Pier J/K, 6 within and 3 outside the transects (Table 1). On the northwest side of the pier (Figure 1, Transects 1-5), barred sandbass (*Paralabrax nebulifer*) occurred along each transect. Spotted sandbass (*Paralabrax maculatofasciatus*), round stingray (*Urolophus halleri*), and California halibut (*Paralichthys californicus*) were observed in low numbers along some transects. On the southeast side of the pier (Transect 6), kelp bass (*Paralabrax clathratus*) and sculpin sp. (Cottidae) were found in relatively high abundance in addition to barred sandbass. Topsmelt (*Atherinops affinis*), spotted sandbass, black surfperch (*Embiotoca jacksoni*), and sargo (*Anisotremus davidsonii*) were seen southeast of the pier outside the volumetric band of the fish transect.

A total of 22 macroinvertebrate species were counted at Pier J/K (Table 2). The cloudy bubble snail (*Bulla gouldiana*) was the most common macroinvertebrate, with average densities of 3 to 41 individuals/m^2 northwest of the pier (Transects 1-5). The tube-dwelling anemone (*Pachycerianthus fimbriatus*) was relatively common at shallow depths (Transect 2), while the covered-lip nassa (*Nassarius tegula*) was abundant further offshore (Transect 1). Southeast of the pier (Transect 6), the native oyster (*Ostrea lurida*) and bubble snails were relatively abundant, averaging about 5 individuals/m^2. Other invertebrates present, but in low numbers, included several molluscs (chione bivalves, snails, nudibranchs, sea slugs), bryozoans, gorgonians, sponges, and tunicates.

Eelgrass occurred along the transects in less than 5% of the area surveyed on the northwest side of the pier (Figure 2). Eelgrass was patchy in distribution and occurred at shallow depths (0 to < -5 ft MLLW). Eelgrass was encountered primarily along Transect 2 (0 ft MLLW). It occurred in small, sparse patches approximately 180 to 300 ft (55 to 91 m) northwest of the pier, with the patches becoming relatively more dense between 336 and 400 ft (102 and 122 m) northwest of the pier (Appendix C). Eelgrass also was encountered on the cross-depth transects in shallow depths at distances of 9 to 30 ft (3 to 9 m) from shore. Along these cross-depth transects, most eelgrass was encountered at least 300 ft (91 m) northwest of the pier (Transect 3), and little eelgrass was encountered closer to the pier (Transects 4 and 5). No eelgrass was encountered at depths of -7 ft to -12 ft MLLW northwest of the pier (Transect 1). Eelgrass was not seen along Transect 6 (-10 ft MLLW) on the southeast side of the pier.

Eelgrass density ranged from 14 to 25 turions/0.25 m^2 (Table 3), corresponding to 56 to 100 turions/m^2 in the relatively denser beds. Patchy beds had densities of 2 to 4 turions/0.25 m^2 (8 to 16 turions/m^2). Small arthropods and snails were seen on eelgrass blades, although in most cases, the percent cover was less than 50%.

Navigational Channel

Transects in the Navigational Channel were at depths of –38 to – 49 ft MLLW and the bay bottom was soft, silty mud. A total of 2 species of fish and 9 macroinvertebrate species were observed (Tables 4 and 5, respectively). Round stingray occurred along all three transects, while barred sandbass was seen only along Transect 3. Macroinvertebrates included brittle stars, hydroids, molluscs (cloudy bubble snail, oyster, channeled nassa), tube-dwelling anemones, sponges, and tunicates. All invertebrates were seen in low abundances, although there were localized patches of relatively high densities of the hydroid *Tubularia crocea*. No eelgrass was encountered nor expected in the relatively deep Navigational Channel.

Pier BravoVicinity

The area surveyed at Pier Bravo had a rip rap shore with rocks extending offshore to approximately - 6 ft MLLW. At that depth, rocks gave way to a flat, mud bottom. The rocks became somewhat smaller in size and spaced farther apart with increasing depth. A total of 13 species of fish were observed at Pier Bravo (Table 6). Kelp bass, blacksmith (*Chromis punctipinnis*), and opaleye (*Girella nigricans*) were the dominant fish in the area both at the shallow (0 ft MLLW) and deeper (- 6 ft MLLW) transect depths. Rock wrasse (*Halichoeres semicinctus*) and giant kelpfish (*Heterostichus rostratus*) also were relatively abundant at the shallower depth (Transect 2), and señorita (*Oxyjulis californica*) and black surfperch were also relatively abundant at the deeper depth (Transect 1).

A total of 16 species of macroinvertebrates were noted at Pier Bravo (Table 7). The scaled worm snail (*Serpulorbis squamigerus*) was the most abundant macroinvertebrate with average densities of 59 to 170 individuals/m^2. The aggregating anemone (*Anthopleura elegantissima*), and the gastropods *Acanthina paucilirata* and *Ceratostoma nuttalli*, also were common in the area. Other molluscs (limpets, scallops, snails, sea slugs), crabs, hermit crabs, sea cucumbers, sea fans, and large worms were observed in low abundance.

No eelgrass was observed along transects at Pier Bravo over the range of survey depths from 0 to -6 ft MLLW.

Discussion and Summary

Biological assemblages differed between the three sites surveyed. The fish assemblage was more diverse and occurred in highest abundance at Pier Bravo. Several of the more abundant fish there, such as kelp bass, blacksmith, opaleye, and senorita, prefer rocky and/or kelp habitats (Eschmeyer et al. 1983). Rip rap occurs along shore and extends offshore at Pier Bravo. The brown alga *Sargassum muticum* grows on many of the rocks. Somewhat in contrast, the shoreline of Pier J/K is typified by a concrete wall along the northwestern shore (Transects 1-5), but has rip rap along the shoreline to the south

(Transect 6). The most abundant fish at Pier J/K was barred sand bass, which usually is found over sand bottoms near rocks (Eschmeyer et al. 1983). More fish species were observed southwest of the pier probably due to the rock rip rap that extended offshore. The fewest number of fish were observed in the Navigational Channel , which was at much greater depths (- 38 to - 49 ft MLLW) than the other sites (0 to -14 ft MLLW). Similar to the fish, fewer species of macroinvertebrates were seen in the Navigational Channel.

In contrast to the fish, more invertebrates were found at Pier J/K than at Pier Bravo. One notable difference in the invertebrate assemblage between these areas was the greater occurrence of less motile species at Pier J/K (e.g., hydroids, oysters, sponges, tube-dwelling anemone, tunicates). Some of those species were associated with rocks on the southeast side of the pier, but several were associated with the softer sediments to the northwest. At Pier Bravo most of the species were associated with the rock rip rap (e.g., aggregating anemone, rock scallop, shore crab, *Serpulorbis* snail, starfish).

The 1997 survey results share similarities, but also differ from previous studies of the same areas. Many of the same species were noted in 1997 as in earlier studies; however, fewer biological resources were documented in 1997. Some of the differences may be influenced by the season, since earlier studies were conducted during spring or summer, while other differences may relate to the opportunistic nature of surveying mobile organisms. However, some of the reductions in eelgrass and less motile species are suggestive of some disturbance to the area over the last several years.

During a May 1993 survey (DON 1995), more eelgrass was observed in the vicinity of Pier J/K than was present during 1997. Similar to 1997, eelgrass densities were highest at shallow depths (< -5 ft MLLW) primarily northwest of Pier J/K. However, more eelgrass was observed in 1993 out to depths of -10 ft MLLW, closer to the pier on the northwest side, and in small patches on the southeast side of the pier. Also eelgrass density was greater in 1993 (up to 576 growth shoots/m^2 = turions/m^2) than in 1997 (up to 100 turions/m^2).

Fewer species of fish and macroinvertebrates were observed at Pier J/K in 1997 than in 1993. A total of 9 species of fish and 22 species of macroinvertebrates were surveyed in 1997; whereas, 15 species of fish and 33 species of macroinvertebrates were seen in 1993 (DON 1995). Similar to 1997, barred and spotted sand bass, California halibut, round stingrays, and kelp bass were commonly encountered in 1993. Other fish seen in 1993 at Pier J/K, but not in 1997, included blacksmith, shiner surfperch, opaleye, rock wrasse, giant kelpfish, and senorita. Macroinnvertebrates observed in 1993, but not in 1997, included lobster, additional molluscs (mussels, scallops, sea hares), colonial tunicates, aggregating anemones, and sea fans.

Similarly, fewer biological resources were documented at Pier Bravo during the November 1997 survey than during a September 1992 survey, also conducted by MEC. A notable difference between years was the lack of eelgrass in 1997. Eelgrass covered about 0.21 acres inshore of the pier in 1992, primarily at depths less than -10 ft MLLW (MEC 1992). Eelgrass also was noted in the vicinity in 1996, although it was declining (B. Hoffman, NMFS, personal communication). A combination of factors may have contributed to the decline in eelgrass at North Island (e.g., warmer water temperatures associated with El Niño and/or turbidity associated with past dredging activities).

Fewer species of fish and macroinvertebrates were noted at Pier Bravo in 1997 than in 1992 (MEC 1992). A total of 13 species of fish were observed in 1997, whereas 18 species were seen in 1992. Not observed in 1997, but seen in 1992, were round stingray, gobies, California halibut, and diamond and hornyhead turbots. Similarly, fewer macroinvertebrates were noted in 1997 (16 species) than in 1992 (22 species). Several of the relatively sessile invertebrates noted in 1992 were not found in 1997 (e.g., bay mussel, sea pens, sponges, tube-dwelling anemone, tunicates). Notable motile invertebrates such as lobster and octopus also were not seen in 1997.

Literature Cited

DON (U.S. Department of the Navy). 1995. Final Environmental Impact Statement for the development of facilities in San Diego/Coronado to support the Homeporting of one NIMITZ class aircraft carrier. Volume 3, Appendix C-17.

Eschmeyer, W.N., E.S. Herald, and H. Hammann. 1983. A Field Guide to Pacific Coast Fishes, North America. The Peterson Field Guide Series. Houghton Mifflin Company, Boston. 336 pp.

MEC Analytical Systems, Inc. 1992. Eelgrass (*Zostera marina*) habitat mapping and reconnaissance survey and dredge impact assessment, Pier Bravo, North Island Naval Air Station. Draft Report, Prepared for U. S. Navy, Southwest Division Engineering Command.

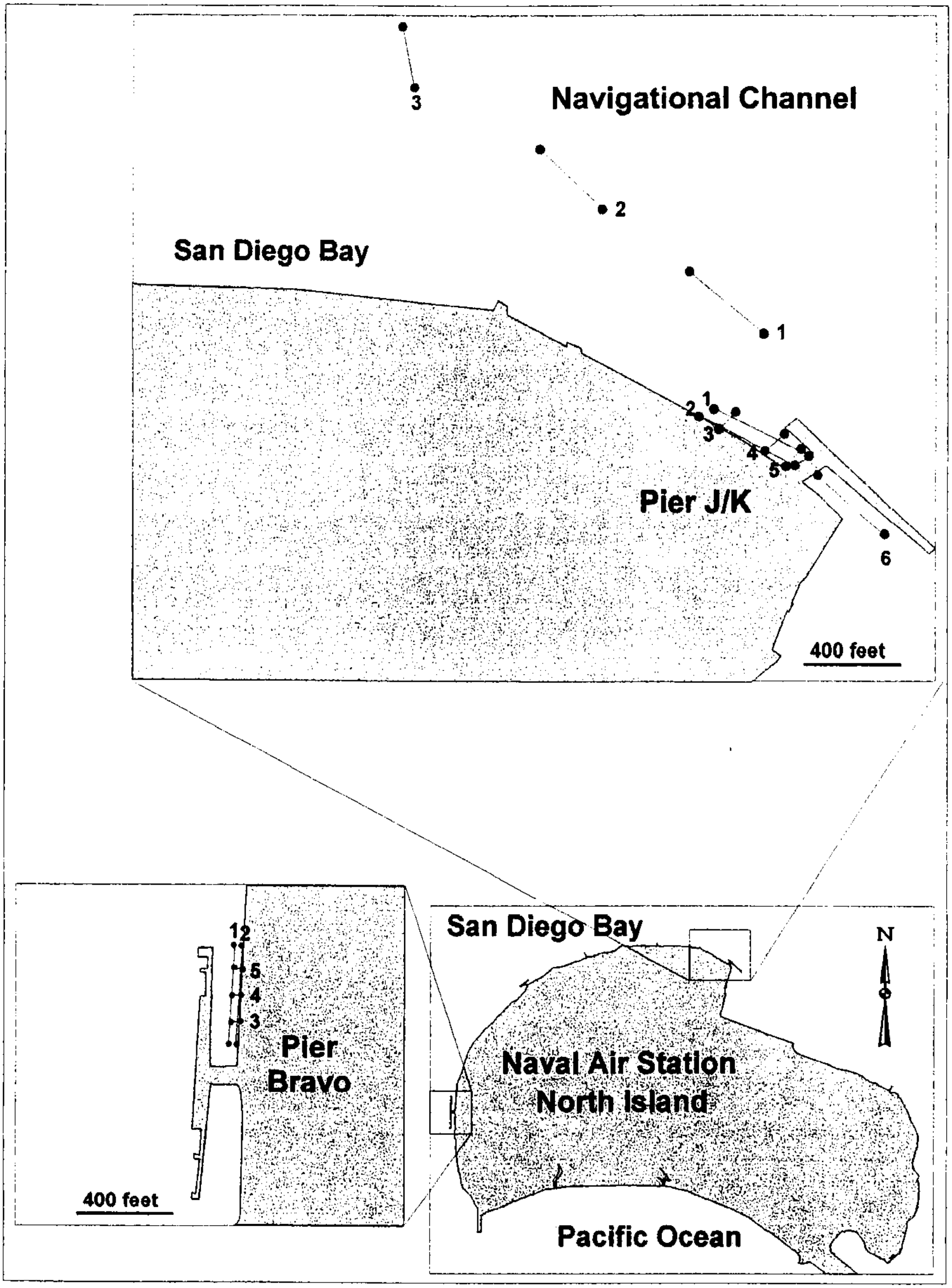

Figure 1. Transect locations at Pier J/K and Pier Bravo dive reconnaissance sites in November 1997.

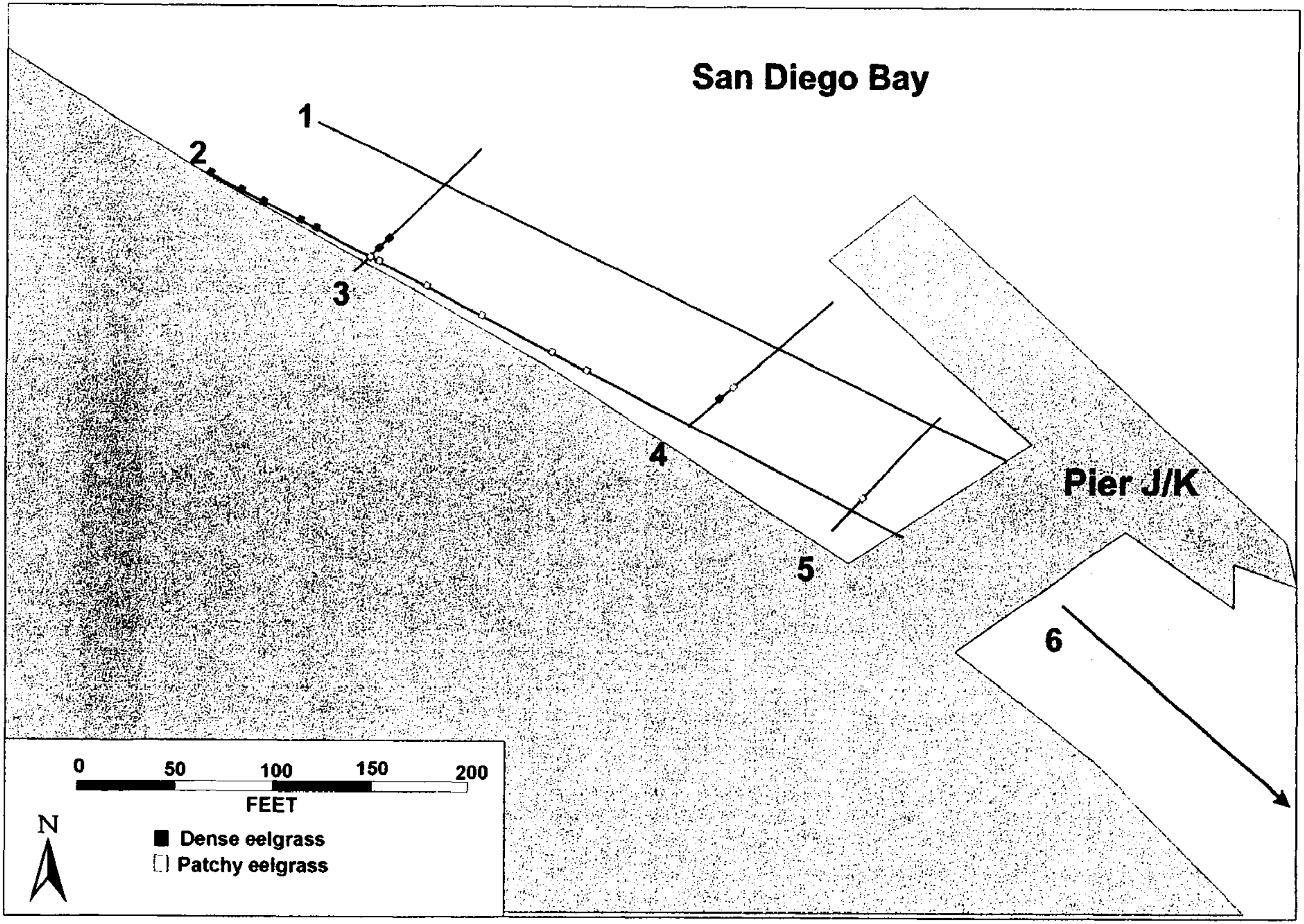

Figure 2. Eelgrass observations at Pier J/K in November 1997.

Table 1. Number of fish counted along transects at Pier J/K in November 1997.

	TRANSECT	1	2	3	4	5	6
	LENGTH (ft)	400	400	100	100	100	400
	BEGIN DEPTH (ft)	-7	0	0	-1	-1	-11
	END DEPTH (ft)	-12	0	-12	-14	-10	-10
Common Name	Scientific Name						
Round stingray	*Urolophus halleri*			1	1		
Topsmelt	*Atherinops affinis*						*
Spotted sandbass	*Paralabrax maculatofasciatus*		2		1	1	*
Barred sandbass	*Paralabrax nebulifer*	6	4	1	3	2	5
Kelp bass	*Paralabrax clathratus*						17
California halibut	*Paralichthys californicus*					1	
Black surfperch	*Embiotoca jacksoni*						*
Unidentified sculpin	Cottidae						11
Sargo	*Anisotremus davidsonii*						*

* Species noted, not counted

Note: Transects 1-5 were located north of pier, transect 6 was south of pier. All depths are MLLW.

Table 2. Average density of macroinvertebrates (within 1 m^2 quadrats) along transects at Pier J/K in November 1997.

Common Name	Scientific Name	Transect					
		1	2	3	4	5	6
Tunicate	Aplausobranchia	0.05	.	.	.	.	.
Bryozoan	*Bugula neretina*	.	.	.	.	.	1.10
Cloudy bubble snail	*Bulla gouldiana*	3.25	41.35	23.40	18.00	17.60	4.70
California stinging anemone	*Bunodeopsis* sp A	.	.	.	.	.	0.15
Wavy chione	*Chione undatella*	.	0.05	.	.	.	.
California cone	*Conus californicus*	.	0.05	.	.	.	.
Hydroid	*Coryne* sp	.	.	.	.	.	1 cm2*
Sand dwelling nudibranch	*Coryphella sabulicola*	.	.	.	.	.	0.05
Salted dorid nudibranch	*Doriopsilla albopunctata*	.	.	.	.	.	0.05
Wentletrap	*Epitonium* sp	.	0.15	.	0.40	.	.
Crumb-of-bread sponge	*Halichondria panicea*	0.05	.	.	.	.	.
Urn sponge	*Leucilla nuttingi*	.	.	.	.	.	0.05
Carinated dove snail	*Mitrella carinata*	.	0.35	.	0.20	.	.
Cnidaria	*Muricea* sp	.	.	.	.	.	0.05
Covered-lip nassa	*Nassarius tegula*	1.75	0.05	.	.	.	.
Navanax sea slug	*Navanax inermis*	.	0.20	.	.	0.20	0.05
Purple olive	*Olivella biplicata*	.	0.05	.	0.40	.	.
Native oyster	*Ostrea lurida*	.	.	.	.	.	5.40
Tube-dwelling anemone	*Pachycerianthus fimbriatus*	0.10	1.00	.	0.40	0.60	.
Festive murex	*Pteropurpura festivas*	.	0.05	0.40	.	.	0.55
Tunicate	*Styela clava*	.	.	.	.	.	0.50
Stalked tunicate	*Styela montereyensis*	0.25	0.05	.	0.40	.	0.70

* Colonial hydroid coverage

Note: Transects 1-5 were located north of pier, transect 6 was south of pier.

Table 3. Average eelgrass turion density (per 0.25 m^2) in dense and/or patchy beds at Pier J/K in November 1997.

	Transect					
Distribution	1	2	3	4	5	6
Dense	None	19	15.5	23	None	None
Patchy	None	4	3	2	4	None

Table 4. Number of fish counted along transects in Navigational Channel in November 1997.

	TRANSECT	1	2	3
	LENGTH (ft)	400	400	400
	BEGIN DEPTH (ft)	-38	-49	-49
	END DEPTH (ft)	-38	-46	-47
Common Name	Scientific Name			
Round stingray	*Urolophus halleri*	3	2	3
Barred sandbass	*Paralabrax nebulifer*			2

Note: All depths are MLLW.

Table 5. Average density of macroinvertebrates (within 1 m^2 quadrats) along transects in the Navigational Channel in November 1997.

Common Name	Scientific Name	Transect		
		1	2	3
Brittle star	*Amphiodia occidentalis*	.	0.05	.
Cloudy bubble snail	*Bulla gouldiana*	0.05	.	.
Mudflat hydroid	*Corymorpha palma*	.	2.10	0.6
Channeled nassa	*Nassarius fossatus*	0.55	0.20	0.1
Native oyster	*Ostrea lurida*	0.15	.	.
Tube-dwelling anemone	*Pachycerianthus fimbriatus*	0.05	0.10	0.1
Tunicate	*Styela* sp	0.05	.	.
Sponge	*Suberites ficus*	.	.	0.1
Pink-mouthed hydroid	*Tubularia crocea*	.	1.3 cm^2 *	.

* Colonial hydroid coverage

Table 6. Number of fish counted along transects at Pier Bravo in November 1997.

	TRANSECT	1	2	3	4	5
	LENGTH (ft)	400	400	35	35	35
	BEGIN DEPTH (ft)	-6	0	-6	-6	-6
	END DEPTH (ft)	-6	0	+4	+4	+4
Common Name	Scientific Name					
Topsmelt	*Atherinops affinis*			5		
Spotted sandbass	*Paralabrax maculatofasciatus*	1				
Barred sandbass	*Paralabrax nebulifer*	2				1
Kelp bass	*Paralabrax clathratus*	20	9	4		
Blacksmith	*Chromis punctipinnis*	13	25		5	
Opaleye	*Girella nigricans*		38	4	14	2
Senorita	*Oxyjulis californica*	12				
Black surfperch	*Embiotoca jacksoni*	7	1			
Rock wrasse	*Halichoeres semicinctus*	3	4	1		1
Garabaldi	*Hypsypops rubicundus*	1	1	1	1	
Salema	*Xenistius californiensis*	1		3		
Giant kelpfish	*Heterostichus rostratus*		4			
Pile surfperch	*Rhacochilus vacca*		1			

Note: All depths are MLLW.

Table 7. Average density of macroinvertebrates (within 1 m^2 quadrats) along transects at Pier Bravo in November 1997.

Common Name	Scientific Name	Transect				
		1	2	3	4	5
Checkered unicorn	*Acanthina paucilirata*	.	2.60	.	.	.
Aggregating anemone	*Anthopleura elegantissima*	.	1.60	.	.	.
Nuttall's hornmouth	*Ceratostoma nuttalli*	.	0.95	0.67	1.67	1.33
File limpet	*Collisella limatula*	.	0.80	.	.	.
California cone	*Conus californicus*	0.35	.	0.33	.	.
Ornate tube worm	*Diopatra ornata*	0.70	.	.	.	0.33
Hermit crab	*Pagurus* sp.	0.05	.	.	.	.
Rock scallop	*Hinnites giganteum*	0.05	.	.	.	0.33
Kellet's whelk	*Kelletia kelletia*	.	0.10	.	.	.
Sea fan	*Muricea californica*	0.75	.	.	0.67	.
Navanax sea slug	*Navanax inermis*	0.10	0.15	.	.	.
Striped shore crab	*Pachygrapsus crassipes*	.	0.05	.	.	.
Sea cucumber	*Parastichopus californicus*	0.10	.	.	.	.
Giant spined star	*Pisaster giganteus*	0.05	.	0.33	.	.
Scaled worm snail	*Serpulorbis squamigerus*	59	95	70	157	170
Speckled turban snail	*Tegula gallina*	.	0.15	.	.	0.33

APPENDIX A – FISH DATA

NAVY HOMEPORTING FISH DATA

DIVERS: Heilprin, James
DATE: 11/19/97 11/19/97 11/19/97 11/19/97 11/19/97 11/20/97
LOCATION: Pier J/K

TRANSECT	1	2	3	4	5	6
DATE	11/19/97	11/19/97	11/19/97	11/19/97	11/19/97	11/20/97
LENGTH (ft)	400	400	100	100	100	400
BEGIN DEPTH (ft)*	-7	0	0	-1	-1	-11
END DEPTH (ft)*	-12	0	-12	-14	-10	-10
SPECIES						
Round stingray			1	1		
Topsmelt						**
Spotted sandbass		2		1	1	**
Barred sandbass	6	4	1	3	2	5
Kelp bass						17
Blacksmith						
Opaleye						
California halibut					1	
Senorita						
Black surfperch						**
Rock wrasse						
Garabaldi						
Salema						
Giant kelpfish						
Pile surfperch						
Unidentified sculpin						11
Sargo						**

* Feet below MLLW

** Species noted, not counted

NAVY HOMEPORTING FISH DATA

DIVERS: Heilprin, James
DATE: 11/20/97 11/20/97 11/20/97
LOCATION: Navigational Channel

TRANSECT	1	2	3
LENGTH (ft)	400	400	400
BEGIN DEPTH (ft)*	-38	-49	-49
END DEPTH (ft)*	-38	-46	-47
SPECIES			
Round stingray	3	2	3
Topsmelt			
Spotted sandbass			
Barred sandbass			2
Kelp bass			
Blacksmith			
Opaleye			
California halibut			
Senorita			
Black surfperch			
Rock wrasse			
Garabaldi			
Salema			
Giant kelpfish			
Pile surfperch			
Unidentified sculpin			
Sargo			

* Feet below MLLW

NAVY HOMEPORTING FISH DATA

DIVERS: Heilprin, James
DATE:11/18/97
LOCATION: Pier Bravo

TRANSECT	1	2	3	4	5
LENGTH (ft)	400	400	35	35	35
BEGIN DEPTH (ft)*	-6	0	-6	-6	-6
END DEPTH (ft)*	-6	0	+4	+4	+4
SPECIES					
Round stingray					
Topsmelt			5		
Spotted sandbass	1				
Barred sandbass	2				1
Kelp bass	20	9	4		
Blacksmith	13	25		5	
Opaleye		38	4	14	2
California halibut					
Senorita	12				
Black surfperch	7	1			
Rock wrasse	3	4	1		1
Garabaldi	1	1	1	1	
Salema	1		3		
Giant kelpfish		4			
Pile surfperch		1			
Unidentified sculpin					
Sargo					

* Feet below MLLW

APPENDIX B – MACROINVERTEBRATE DATA

NAVY HOMEPORTING MACROINVERTEBRATE DATA

DIVERS: Heilprin, James
LOCATION: Pier J/K
DATE: 11/19/97

TRANSECT	START	END	SPECIES	Q1	Q2	Q3	Q4	Q5
1	0	100	Aplausobranchia	1				
1	100	200	Bulla gouldiana				1	
1	100	200	Pachycerianthus fimbriatus				1	
1	100	200	Styela montereyensis				1	
1	100	200	Nassarius tegula				15	
1	200	300	Halichondria panicea	1				
1	200	300	Bulla gouldiana		1	12	10	15
1	200	300	Styela montereyensis			2	2	
1	300	400	Bulla gouldiana	10	10	1	2	3
1	300	400	Pachycerianthus fimbriatus		1			
1	300	400	Nassarius tegula					20
2	0	100	Bulla gouldiana	6	64	39	15	48
2	0	100	Pachycerianthus fimbriatus	1				
2	0	100	Nassarius tegula		1			
2	0	100	Navanax inermis				1	
2	0	100	Conus californicus				1	
2	0	100	Epitonium sp				2	
2	0	100	Pteropurpura festivas				1	
2	0	100	Chione undatella				1	
2	100	200	Bulla gouldiana	89	65	17	15	1
2	100	200	Epitonium sp	1				
2	100	200	Styela montereyensis			1		
2	100	200	Navanax inermis			1		1
2	100	200	Pachycerianthus fimbriatus			2	5	
2	200	300	Bulla gouldiana	5	12	17	39	61
2	200	300	Navanax inermis		1			
2	200	300	Pachycerianthus fimbriatus		1		8	
2	200	300	Olivella biplicata		1			
2	300	400	Bulla gouldiana	27	92	86	63	66
2	300	400	Mitrella carinata	1	6			
2	300	400	Pachycerianthus fimbriatus		2			1
2	300	400	Ophiodermella ophioderma					
3	0	100	Bulla gouldiana	3	87	24	1	2
3	0	100	Pteropurpura festivas	2				
4	0	100	Bulla gouldiana	41	45	4		
4	0	100	Olivella biplicata	2				
4	0	100	Pachycerianthus fimbriatus		2			
4	0	100	Epitonium sp		2			
4	0	100	Mitrella carinata		1			
4	0	100	Styela montereyensis					2
5	0	100	Bulla gouldiana	3	40	29	16	
5	0	100	Pachycerianthus fimbriatus		2		1	
5	0	100	Navanax inermis			1		
6	0	100	Pteropurpura festivas					2
6	0	100	Styela clava					1
6	100	200	Navanax inermis	1				
6	100	200	Leucilla nuttingi	1				
6	100	200	Pteropurpura festivas		4	1	4	
6	100	200	Styela clava		1			
6	100	200	Ostrea lurida			1	1	10
6	100	200	Styela montereyensis			2		
6	100	200	Muricea sp				1	
6	100	200	Coryne sp				20 cm2	
6	100	200	Bugula neretina				1	1
6	200	300	Bugula neretina	3		4	7	5
6	200	300	Styela montereyensis	1			4	3
6	200	300	Doriopsilla albopunctata	1				
6	200	300	Ostrea lurida		26	20	5	4
6	200	300	Coryphella sabulicola			1		
6	200	300	Bulla gouldiana			2	1	3
6	200	300	Styela clava					6
6	300	400	Styela clava	1			1	
6	300	400	Bulla gouldiana	19	23	34		12
6	300	400	Ostrea lurida	3		4	34	
6	300	400	Styela montereyensis	2		1	1	
6	300	400	Bugula neretina				1	
6	300	400	Bunodeopsis sp A					3

NAVY HOMEPORTING MACROINVERTEBRATE DATA

DIVERS: Heilprin, James
LOCATION: Navigational Channel
DATE: 11/20/97

TRANSECT	START	END	SPECIES	Q1	Q2	Q3	Q4	Q5
1	0	100	None					
1	100	200	Nassarius fossatus		5	3		1
1	200	300	Nassarius fossatus	1	1			
1	200	300	Bulla gouldiana			1		
1	300	400	Pachycerianthus fimbriatus				1	
1	300	400	Ostrea lurida					3
1	300	400	Styela sp					1
2	0	100	Nassarius fossatus			2		
2	100	200	Corymorpha palma	3		1		14
2	100	200	Nassarius fossatus		1			
2	100	200	Pachycerianthus fimbriatus		1			1
2	200	300	Corymorpha palma	7	1			3
2	200	300	Tubularia crocea				25 cm2	
2	300	400	Corymorpha palma		1	8	3	1
2	300	400	Tubularia crocea		1 cm2			
2	300	400	Amphiodia occidentalis				1	
2	300	400	Nassarius fossatus					1
3	0	100	Suberites ficus			1		
3	0	100	Pachycerianthus fimbriatus				1	
3	100	200	Pachycerianthus fimbriatus	1				
3	200	300	Suberites ficus			1		
3	200	300	Corymorpha palma				1	
3	300	400	Corymorpha palma	6	3			2
3	300	400	Nassarius fossatus		1		1	

NAVY HOMEPORTING MACROINVERTEBRATE DATA

DIVERS: Heilprin, James
LOCATION: Pier Bravo
DATE: 11/18/97

TRANSECT	START	END	SPECIES	Q1	Q2	Q3	Q4	Q5
1	300	400	Pisaster giganteus	1				
1	300	400	Muricea californica	1	2	1	2	1
1	300	400	Parastichopus californicus	1				
1	300	400	Serpulorbis squamigerus	80	45	20	20	100
1	200	300	Conus californicus	3				1
1	200	300	Muricea californica	1	2		1	2
1	200	300	Diopatra ornata	2		2	1	
1	200	300	Serpulorbis squamigerus	75	220			30
1	200	300	Hinnites giganteum		1			
1	200	300	Hermit crab			1		
1	200	300	Navanax inermis				1	1
1	100	200	Serpulorbis squamigerus	210	10			10
1	100	200	Parastichopus californicus		1			
1	100	200	Diopatra ornata				4	4
1	0	100	Diopatra ornata	1				
1	0	100	Conus californicus	3				
1	0	100	Serpulorbis squamigerus	60	230	20		50
1	0	100	Muricea californica		1			1
2	0	100	Navanax inermis	1				
2	0	100	Serpulorbis squamigerus	55	70	100	20	160
2	0	100	Kelletia kelletia		2			
2	0	100	Anthopleura elegantissima			1		
2	0	100	Acanthina paucilirata				7	7
2	100	200	Serpulorbis squamigerus	180	170	100	30	110
2	100	200	Acanthina paucilirata					11
2	100	200	Collisella limatula	8				
2	100	200	Ceratostoma nuttalli	3				
2	100	200	Tegula gallina		2			
2	100	200	Ceratostoma nuttalli		1			3
2	100	200	Anthopleura elegantissima			1	6	4
2	200	300	Serpulorbis squamigerus	85	170	85	70	150
2	200	300	Anthopleura elegantissima	10			5	
2	200	300	Navanax inermis	1				1
2	200	300	Ceratostoma nuttalli	1				
2	200	300	Acanthina paucilirata	1	11			
2	200	300	Ceratostoma nuttalli		5		1	2
2	200	300	Collisella limatula			2		
2	200	300	Tegula gallina					1
2	300	400	Serpulorbis squamigerus	50	90	60	30	120
2	300	400	Anthopleura elegantissima	4			1	
2	300	400	Acanthina paucilirata		5	4	4	2
2	300	400	Collisella limatula		6			
2	300	400	Ceratostoma nuttalli		1			
2	300	400	Ceratostoma nuttalli			1		
2	300	400	Pachygrapsus crassipes			1		
2	300	400	Ceratostoma nuttalli				1	
3	300	300	Serpulorbis squamigerus	30	20	160		
3	300	300	Conus californicus	1				
3	300	300	Ceratostoma nuttalli	1				
3	300	300	Pisaster giganteus			1		
3	300	300	Ceratostoma nuttalli			1		
4	200	200	Serpulorbis squamigerus	80	160	230		
4	200	200	Ceratostoma nuttalli	3				
4	200	200	Muricea californica	2				
4	200	200	Ceratostoma nuttalli		1	1		
5	100	100	Serpulorbis squamigerus	150	120	240		
5	100	100	Diopatra ornata	1				
5	100	100	Ceratostoma nuttalli		1			
5	100	100	Ceratostoma nuttalli		3			
5	100	100	Tegula gallina		1			
5	100	100	Hinnites giganteum			1		

APPENDIX C – EELGRASS DATA

NAVY HOMEPORTING EELGRASS DATA

DIVERS: Heilprin, James
DATE: 11/19/97
LOCATION: Pier J/K

TRANSECT #/Length (ft)	SECTION		EELGRASS DISTRIBUTION		EELGRASS DENSITY per 0.25 m2	EPIPHYTES ON BLADES	EPIPHYTE PERCENT COVER	NOTES
	BEGIN	END	DENSE	PATCHY				
1/400								No eelgrass
2/400	397	400	X		14.75	None	<50	
	379	382	X		14	None	<50	
	366	369	X		18.25	None	<50	
	345	348	X		24.75	None	<50	
	336	339	X		36	Bulla	<50	
	300	303		X	3	Snail	<50	
	272	275		X	2	None	<50	
	240	243		X	5	Epiactus	<50	
	197	200		X	4	Epiactus,snail	<50	
	180	183		X	7	Snail	<50	
3/100	9	12		X	3	None	<50	
	14	17	X		18	Navanax, Epiactus	>50	
	21	24	X		13	Bulla	<50	
4/100	19	22	X		23	Epiactus,snail	>50	Patch too small for 3 quadrats
	26	29		X	2	Epiactus	>50	
5/100	21	24		X	4	Epiactus	>50	
6/400								No eelgrass

APPENDIX D – TRANSECT COORDINATES AND DEPTH DATA

Location	Transect Number	Transect Position	Latitude		Longitude	
Pier J/K	1	Start	32	42.769	117	11.384
		End	32	42.800	117	11.459
	2	Start	32	42.763	117	11.395
		End	32	42.794	117	11.471
	3	Start	32	42.786	117	11.455
		End	32	42.799	117	11.439
	4	Start	32	42.772	117	11.419
		End	32	42.787	117	11.401
	5	Start	32	42.762	117	11.402
		End	32	42.777	117	11.394
	6	Start	32	42.758	117	11.375
		End	32	42.715	117	11.310
Navigational Channel	1	Start	32	42.852	117	11.425
		End	32	42.893	117	11.484
	2	Start	32	42.933	117	11.551
		End	32	42.975	117	11.604
	3	Start	32	43.007	117	11.705
		End	32	43.049	117	11.709
Pier Bravo	1	Start	32	41.833	117	13.625
		End	32	41.767	117	13.625
	2	Start	32	41.833	117	13.632
		End	32	41.767	117	13.632
	3	Start	32	41.784	117	13.625
		End	32	41.784	117	13.632
	4	Start	32	41.800	117	13.625
		End	32	41.800	117	13.632
	5	Start	32	41.817	117	13.625
		End	32	41.817	117	13.632

Navy Homeporting Transect Depths

Location	Transect	Start/End	Recorded Depth (ft)	Time	Date	Tide Height (ft)	Depth MLLW
Pier J/K	1	Start	12	1007	11/19/97	4.7	-7
		End	17	1107	11/19/97	5.2	-12
	2	Start	5	1130	11/19/97	5.2	0
		End	5	1230	11/19/97	5.2	0
	3	Start	5	1330	11/19/97	4.7	0
		End	17	1345	11/19/97	4.6	-12
	4	Start	5	1400	11/19/97	4.4	-1
		End	18	1408	11/19/97	4.3	-14
	5	Start	5	1420	11/19/97	4.1	-1
		End	14	1428	11/19/97	4	-10
	6	Start	15	0929	11/20/97	3.6	-11
		End	14	1039	11/20/97	4.1	-10
Navigational Channel	1	Start	42	1421	11/20/97	4.3	-38
		End	42	1442	11/20/97	4.4	-38
	2	Start	52	0903	11/21/97	3	-49
		End	49	0937	11/21/97	3.1	-46
	3	Start	52	1049	11/21/97	3.3	-49
		End	50	1115	11/21/97	3.4	-47
Pier Bravo	1	Start	12	1028	11/18/97	5.8	-6
		End	12	1138	11/18/97	5.8	-6
	2	Start	5	1235	11/18/97	5.3	0
		End	5	1320	11/18/97	4.6	0
	3	Start	10	1330	11/18/97	4.4	-6
		End	0	1345	11/18/97	4.1	4
	4	Start	10	1350	11/18/97	4	-6
		End	0	1400	11/18/97	3.8	4
	5	Start	10	1405	11/18/97	3.7	-6
		End	0	1415	11/18/97	3.5	4

WHARF SHADING IMPACT STUDY PRELIMINARY INVESTIGATIONS

FEBRUARY, 1999

Prepared for:

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WHARF SHADING IMPACT STUDY PRELIMINARY INVESTIGATIONS

FEBRUARY, 1999

INTRODUCTION

The U.S. Navy is proposing the construction of a marginal wharf along the east edge of Naval Air Station, North Island (NASNI) as a part of the CVN homeporting project. The wharf would extend bayward approximately 20m and would cover approximately 6,000 m^2 of intertidal, shallow subtidal, and medium subtidal waters. Historically, the placement of wharves, docks, and piers has been viewed as reasonably self-mitigating or neutral with respect to impacts to fish and benthic communities. Such structures tend to provide increased three dimensional substrate and cover that locally increases productivity of encrusting benthic organisms and also serves to locally increase richness and abundance of fish over the conditions observed in more open waters.

However, there has been some concern that there may be diminishing return from larger structures and that negative impacts may result which exceed the positive effects associated with structures. Biological communities under more expansive structures may be fundamentally different than those found along the fringes of the structure or around smaller structures. Intuitively, this concern has some merit. The physical environment beneath a larger structure would be expected to differ somewhat from that observed along the edges of the structure. Under large pile supported structures, light levels are lower, support piles reduce currents and wave energies and create strongly depositional environments, and water circulation is expected to be reduced.

To briefly explore this issue and begin to evaluate the biologic conditions expected to develop under the proposed wharf structure at NASNI, a preliminary review was made of comparable conditions occurring elsewhere in San Diego Bay. The study site was the end of Pier 13 at the Naval Station (NAVSTA) along the eastern shoreline of the bay. The NAVSTA piers provide a pier face and a gradient of physical conditions extending under the pier into complete darkness. The Pier 13 finger pier environment differs somewhat from that expected at the proposed NASNI marginal wharf, however, for coarse comparisons the sites are expected to be reasonably similar.

This investigation examined benthic infauna, encrusting pile communities, and fish resources under and around NAVSTA, Pier 13. The purpose of the review was exploratory in nature and designed to identify any obvious differences in communities during the winter season survey.

METHODS

Studies were conducted at Pier 13 NAVSTA on February 4, 1999 from 1430 to 1630 hours (Figure 1). The survey staff included biologists Mitchell Perdue (USN SWDIV), Keith W. Merkel (Merkel & Associates, Inc.), Bob Hoffman (National Marine Fisheries Service) and Kevin J. Cull (Merkel & Associates, Inc.). Weather conditions were rainy, overcast skies and a water visibility of 6-7m. Three sampling regions were established to determine the general richness and composition of observed marine communities and abundance of fish, as well as encrusting pile and benthic invertebrate species composition under the 20m wide pier. These were: 1) the *exposed region*

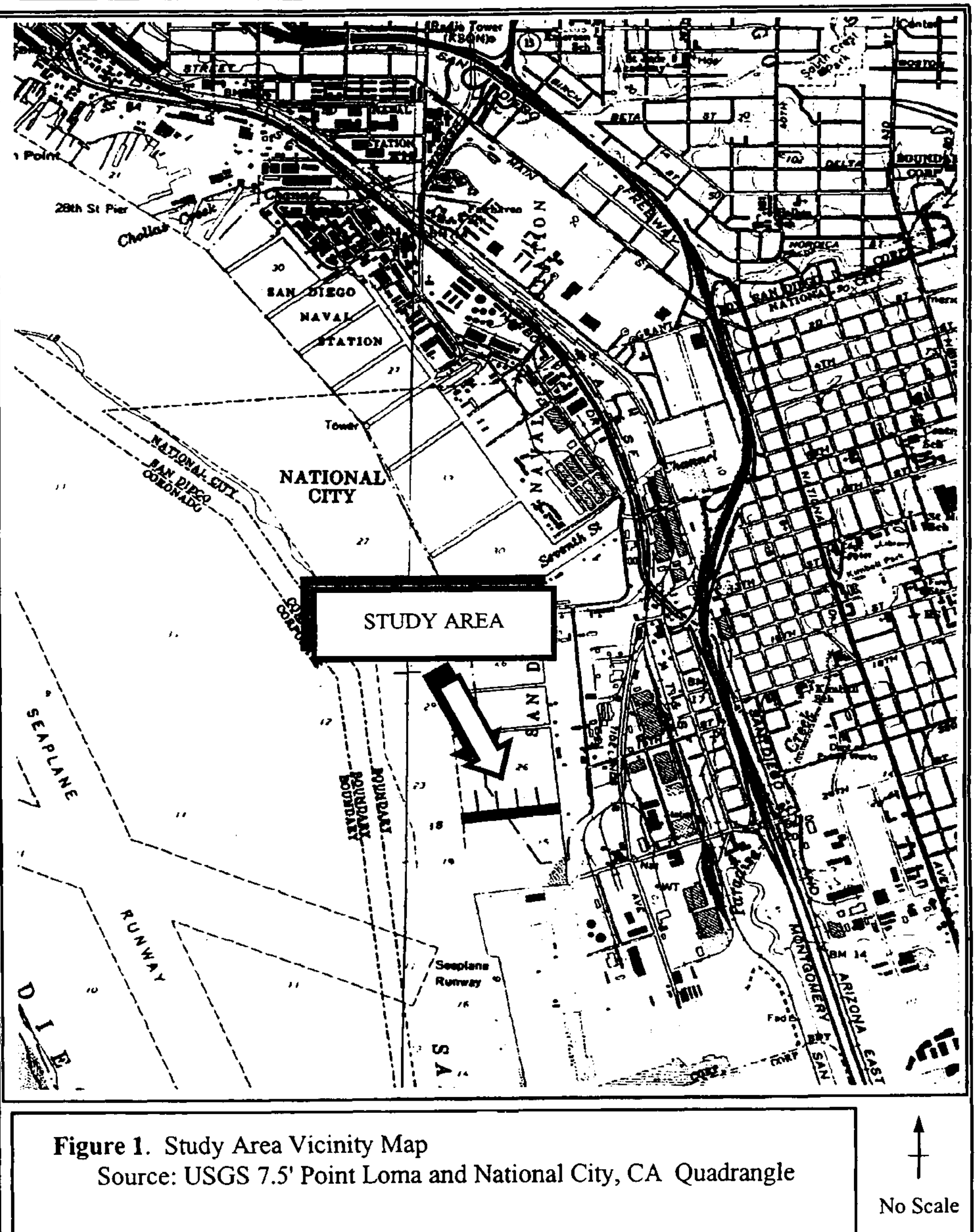


Figure 1. Study Area Vicinity Map
Source: USGS 7.5' Point Loma and National City, CA Quadrangle

outside of any pier cover along the face of the pier; 2) the *shade region* beneath the pier approximately 10m from the face where light levels were such that objects could be seen, but fine details could not be distinguished, and; 3) the *dark region* located approximately 30m from the face of the pier and 10m from each side of the pier (the presence of berthed ships further shaded the sides of the pier). In the dark region, no forms or objects could be distinguished without artificial lighting.

Within each of the three regions, surveys were conducted along transects located approximately 3m below the surface and along the bottom in approximately 10m of water. Transects ran parallel to the width of the pier, approximately 20m. However, the two transects in the dark sampling region ran perpendicular to the other transects to avoid the twilight areas along the pier edges in order to ensure complete darkness within that sampling region. All studies were conducted using SCUBA. Video was also taken to aid in later comparisons of habitat conditions within the various regions.

FISH COMMUNITIES

Divers slowly swam the length of each transect and recorded the numbers and species of all fish encountered. A flashlight was used to aid in fish identification within the shade and dark regions. Surveys proceeded at a relatively constant pace requiring approximately 5 minutes to complete each transect. Only fish within an approximate distance of 3m from the centerline of the transect were counted. Fishes beyond this distance were generally not identifiable without abandoning the transect in pursuit. Fish surveys included a search of all microhabitats represented on the transect including open water, on and around piles, as well as on the bottom, where such areas were present. Where fish were observed, but not found on transects, this was noted, but not included in numerical summaries.

ENCRUSTING PILE COMMUNITIES

Pier pilings were closely examined along each transect to note visual differences in the composition of encrusting communities. A video camera was used to document pile communities and allow for later review. No scrapings were taken and no detailed analysis of community composition was made.

BENTHIC INFAUNAL COMMUNITIES

Benthic infaunal communities were examined to determine if there were notable potential differences in this fish foraging resources across a gradient from the exposed to the dark region. Within each of the three regions, three sediment core samples were collected along the bottom transect at an approximate depth of 10m. Each sample was rinsed through a 1.0 mm sieve and organisms from each sample were transferred to Whir-Pak® bags, and preserved with a 10% formalin:seawater mixture. After approximately one week, benthic samples were transferred in the laboratory from the formalin solution into 70% isopropyl alcohol and stained with rose bengal. All individuals in each replicate sample were identified to family and counted. Organisms from the samples collected were then grouped by phylum and weighed to determine the wet weight biomass of each phylum. Wet weight was determined by first transferring an entire sample (or phylum), including alcohol, onto a paper towel and quickly blotting excess liquid from the animals. Organisms were then transferred to a tared weighing dish and weighed to the nearest 0.001g using an analytical balance. Each replicate sample was stored in paraffin-sealed jars of alcohol and kept in the laboratory as voucher samples.

RESULTS

Fish Communities

Fish community richness and abundance was extraordinarily low throughout all transects (Table 1). One school of fish (black croakers; *Cheilotrema saturnum*) was noted in the dark region under the pier but was not found on the transect. Within the surveyed transects, an approximate equal number of fish were observed in the three shading regions.

Table 1. Summary of fish diversity and abundance for each transect.

Species	3m Dark Region	10m Dark Region	3m Shade Region	10m Shade Region	3m Exposed Region	10m Exposed Region
Spotted Bass (*Paralabrax maculatofasciatus*)		2		1		
California Scorpionfish (*Scorpaena guttata*)		1				
Round Stingray (*Urolophus halleri*)	1				1	3
Black Croaker (*Cheilotrema saturnum*)		*				
Total Fish	1	3	0	1	1	3

*A school of several hundred black croaker (*Cheilotrema saturnum*) was observed under the pier, however the school was not on the surveyed transect.

Encrusting Pile Communities

Encrusting organisms occupied nearly one hundred percent of the primary space available on piles within all three exposure regions. Communities were predominated by sponges in all regions and at all depths. However, some differences were noted in the communities. Rock jingles and scallops were abundant on the exposed region piles and nearly absent from the dark piles. Similarly, foliose bryozoans and stalked tunicates were abundant on the exposed piles and diminished in numbers towards the dark region. Pile communities in the exposed region at 3m supported some minor amounts of green and red algae. Not surprisingly, no algae was observed elsewhere. Small mobile invertebrates including nemertean worms, amphipods, shrimp, decorator crabs, and gastropods were observed on piles in all three regions. One physical difference noted between the pile communities was a pronounced gradient of increasing silt load on pile communities from the exposed area to the dark region. This difference alone may account for the differences in community composition observed along the exposure gradient.

Benthic Infaunal Communities

Richness and Density of Infauna

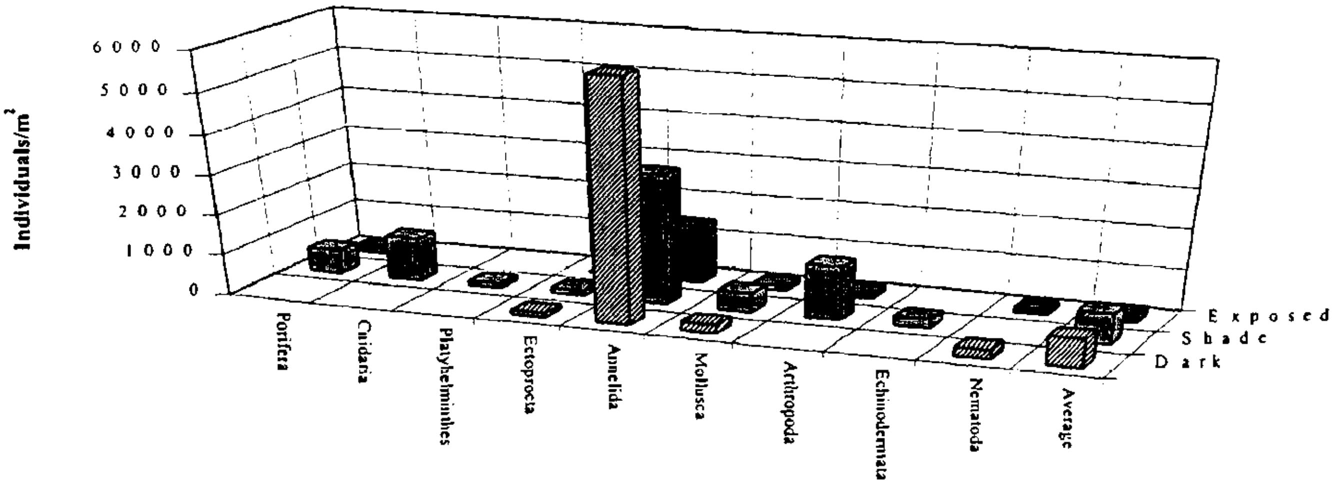
A total of 134 organisms, representing 9 phyla, were collected in the three sampling regions (Table 2). Samples were numerically dominated by the phylum Annelida. All other phyla were represented in relatively lower numbers.

Table 2. Infauna diversity and density (individuals/m^2) by taxonomic group for each sampling region (1mm sieve).

			Dark Region			Shade Region			Exposed Region		
		Replicate	**#1**	**#2**	**#3**	**#1**	**#2**	**#3**	**#1**	**#2**	**#3**
PHYLUM	CLASS	FAMILY									
Proifera							5			1	
Cnidaria											
Platyhelminthes											
Ectoprocta					1		1				
Annelida	**Polychaeta**	**Capitellidae**	2	2	3		1		1		
		Dorvilleidae	1	3	6		2	2			
		Flabelligeridae	1		1			3	2		
		Lumbrineridae	2	1	3	1	2	3	4		2
		Nereidae		2	2			1			
		Oligochaeta			2						
		Opheliidae		3	3	1				1	
		Orbiniidae	1	1	2			1			
		Polynoidae				1	1				
		Spionidae		1	1						
		Syllidae			2						
		Unknown Poly		1	1	1	2				
Mollusca			1	1		3	1				
Arthropoda						9	1	2			
Echinodermata							2				
Nematoda					2					3	
TOTAL INDIVIDUALS COLLECTED PER SAMPLE			8	15	27	16	13	12	7	2	2

The overall average density of organisms was marginally higher in the shade region than in the exposed region (Figure 2). However greater numbers of annelids and nematodes were present in the dark region, while the exposed region supported the lowest abundance of this group. The community richness was best developed in the shade region where species groups were more evenly represented. The composition of benthic communities in the shade and dark regions reflects both the mud bottom nature of the site as well as a rain of organisms and organic waste from the pile communities above. For this reason, several of the animals collected in benthic samples are representatives of the encrusting cryptic communities found on piles, but which remain live on the bottom. High variability between replicate samples precludes any statistically valid quantitative analysis of infaunal communities.

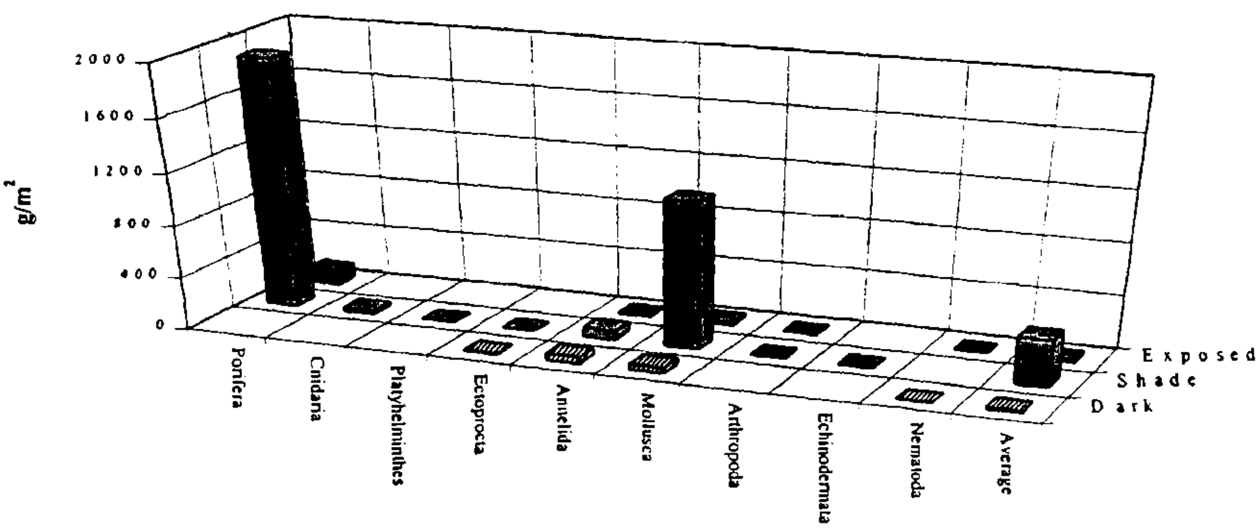
Figure 2. Mean density of invertebrate taxa present within benthic infauna samples collected at Pier 13 NAVSTA in February 1999.



Biomass of Infauna

The phylum Porifera (sponges) ranked highest in average biomass, comprising 60% of the total biomass for all samples (Figure 3). The phylum Mollusca ranked second in biomass, comprising 35% of the total biomass for all samples. Sponges are all derived from the piles above and may be dislodged by waves or propeller wash from ships or tugs using the piers.

Figure 3. Mean biomass of invertebrate taxa present within benthic infauna samples collected at Pier 13 NAVSTA in February 1999.



Overall biomass revealed an overall higher biomass within the shade region. However, the numerically dominant annelids were dwarfed by the much larger biomass of sponges and bivalve mollusks. While sponges and bivalves dominated the weights of the samples, sponges have little value as a forage base for fish of San Diego Bay.

Again, like the density data, biomass varied substantially between replicates and no statistical analyses of the data are possible.

DISCUSSION

The purpose of the investigation was limited to a gross characterization of the biological conditions within a few marine communities across an environmental gradient of shading under pile supported structures with the purpose of determining if there is a reason to suspect that fish community values or a foraging-base for fish are reduced or eliminated under such features. The results provided evidence that areas beneath structures continue to support a foraging-base for fish.

The present survey indicated that an infaunal community persists under pile supported structures within San Diego Bay and that, in this instance, a numerically greater number of organisms were found in the infauna under the piers than outside of the piers. The pile community observed under the pier was reduced in richness from that found along the outer edges of the pier, however a developed pile community existed in all areas.

Fish communities were poorly represented in all surveyed zones and may likely be attributed to seasonality more so than site or region specific reasons. A follow-up spring or summer review of the fish may result in better developed fish communities than observed during the winter survey. However, recognizing the paucity of individuals observed, it can be stated that fish were found in approximately equivalent numbers in all regions.

The occurrence of the large school of black croaker in the dark region of the pier may be akin to large schools of pelagic species which amass around the outer fringes of structures. This observation may provide some insight into where these night foraging fish spend the daylight hours.

It is critical to keep in mind that the present study was far from a rigorous test of shading effects. No quantitative analysis could be performed due to low sample size and no seasonal differences were examined. The surveys were performed during the winter season, during which fish species typically are less abundant. Therefore, the same conclusions cannot be made for effects of fish resource utilization during other seasons. Further, the analysis of community differences also focused on comparisons of areas with pile structures only and did not review differences between areas with piles and areas lacking these vertical structures. As such, it would not be appropriate to suggest that the present data sheds any light on questions regarding whether or not an open mud bottom and water column habitat would have a greater or lesser habitat value than a site with piles, with or without shading.

SECTION 3.6

NASNI SUPPLEMENTAL BIOLOGICAL RESOURCES INFORMATION

Table 3.6-1. Rare, Threatened, Endangered, and Candidate/Special Concern Species Potentially Occurring in the Vicinity of North Island

Common Name (Scientific Name)	*Status[1]*	*Occurrence (Reference)*
	Plants	
Aphanisma (*Aphanisma blitoides*)	FSC, CNPS 1B	Records from around San Diego Bay, occurs in coastal alkaline areas; flowers April-May (Beauchamp 1986).
Coastal dunes milk vetch (*Astragalus tener* var. *titi*)	FPE, SE	Occurs north of Silver Strand Bayside campground; flowers March-May (DON 1992c).
Coastal wallflower (*Erysimum ammophilum*)	FSC	Occurred historically along the Silver Strand but not observed in recent years; flowers February-May (DON 1992c).
Nuttall's lotus (*Lotus nuttallianus*)	FSC, CNPS 1B	Common in coastal dunes, old fill sites around San Diego Bay including North Island, Border Field State Park, Naval Amphibious Base, Coronado, Sweetwater Marsh, Naval Radio Receiving Marsh, and north and south Delta Beach; flowers March-June (DON 1992c, 1995a).
Coast woolly heads (*Nemacaulis denudata* var. *denudata*)	—[2], CNPS 2	Coastal dune habitats, with Nuttall's lotus on North Island shoreline; flowers April-September (Beauchamp 1986; DON 1995a).
Beach broom rape (*Orobanche parishii* ssp. *brachyloba*)	FSC, CNPS 1B	On sandy beaches; parasitic, known hosts include *Atriplex californica* and *Isocoma veneta*; flowers May-September (Beauchamp 1986).
	Insects	
Saltmarsh wandering skipper butterfly (*Panoquina panoquinoides errans*)	FSC	Larvae develop on saltgrass (moist, saline soils) (DON 1992c).
Barrier beach tiger beetle (*Cicindela hirticolis gravida*)	FSC	Found on clean, dry light-colored sand; possible on the Silver Strand (DON 1992c).
Globose dune beetle (*Coelus globosus*)	FSC	Found under dune vegetation (DON 1992c).
	Reptiles	
Silvery legless lizard (*Anniella pulchra pulchra*)	FSC, CSC	Associated with dune plant root systems; known from Tijuana River estuary (Zedler et al. 1992).
San Diego horned lizard (*Phyronsoma coronatum blainvillii*)	FSC, CSC	Inhabits sandy soils, feeds on wood ants, harvester ants. Known from backdune habitats on the Silver Strand (DON 1992c).
	Birds	
Common loon (*Gavia immer*)	CSC (breeding only)	In San Diego Bay, uncommon to fairly common migrant and winter visitor, rare to uncommon summer (DON 1994b); infrequently in nearshore ocean waters (Unitt 1984).
California brown pelican (*Pelecanus occidentalis californicus*)	SE, FE	Common resident of San Diego Bay, feeding in bay and ocean, roosting in all shoreline habitats; common along North Island shoreline (DON 1994b).

Table 3.6-1. Rare, Threatened, Endangered, and Candidate/Special Concern Species Potentially Occurring in the Vicinity of North Island

Common Name (Scientific Name)	*Status*[1]	*Occurrence (Reference)*
	Birds	
Double-crested cormorant (*Phalacrocorax auritus*)	CSC (rookery only)	Common non-breeding visitor, rookery at Saltworks in south San Diego Bay; expected along shoreline of North Island (DON 1994b).
Reddish egret (*Egretta rufescens*)	FSC, CSC	Rare visitor to San Diego Bay, occurs in salt marshes, shorelines of sloughs and river channels (DON 1992c).
Cooper's hawk (*Accipiter cooperi*)	CSC	Fall migrant at Point Loma (Unitt 1984).
Sharp-shinned hawk (*Accipiter striatus*)	CSC	Occasionally seen during winter, migration; fall migrants at Point Loma (DON 1992c).
Northern harrier (*Circus cyaneus*)	CSC (nesting only)	Occasional migrant, primarily reported from south bay (DON 1992c).
Osprey (*Pandion haliaatus carolinensis*)	CSC (nesting only)	Uncommon visitor (non-breeding) occasionally along North Island shoreline (DON 1994b).
Merlin (*Falco columbarius*)	CSC	Rare winter and early spring migrant, predatory on shorebirds (DON 1992c).
Prairie falcon (*Falco mexicanus*)	CSC (nesting only)	Rare to uncommon migrant, winter visitor; occurs in fields, grassland (DON 1992c).
American peregrine falcon (*Falco peregrinus anatum*)	FE, SE	Occasionally seen foraging in San Diego Bay, associated with shorebirds, waterfowl (e.g., Copper and Patton 1992). Nests on Coronado Bridge (DON 1994b).
Light-footed clapper rail (*Rallus longirostris levipes*)	FE, SE	Resident of cordgrass-dominated salt marsh habitat; a few localities in southern San Diego Bay; occurs at Sweetwater Marsh (Unitt 1984; MBA 1990; DON 1992c).
Western snowy plover (*Charadruis alexandrinus nivosus*)	FT, CSC	Several nesting locations around San Diego Bay, Silver Strand North Island; uncommon migrant, winter visitor (Unitt 1984; DON 1994b); forages on beaches.
Long-billed curlew (*Numenius americanus*)	CSC (breeding only)	Common during migration, winter, occasional as a summer visitor; occurs on mudflats, salt marshes, fields (DON 1992c; DON 1994b).
Gull-billed tern (*Sterna nilotica*)	CSC (nesting colony only)	Nests at Saltworks in south San Diego Bay, most sightings also in south bay (DON 1994b).
California gull (*Larus californicus*)	CSC (nesting colony only)	Abundant fall-through-spring resident in shoreline habitats, throughout San Diego Bay (DON 1992c).
Black skimmer (*Rynchops niger*)	CSC (nesting colony only)	Common resident, breeding in south San Diego Bay; likely in nearshore habitats on North Island and elsewhere (DON 1994b).
Elegant tern (*Sterna elegans*)	FSC, CSC (nesting colony only)	Nesting colony in south San Diego Bay; common on beaches, mudflats, open water, and resting on shoreline structures (DON 1994b).

Table 3.6-1. Rare, Threatened, Endangered, and Candidate/Special Concern Species Potentially Occurring in the Vicinity of North Island

Common Name (Scientific Name)	*Status[1]*	*Occurrence (Reference)*
Birds		
California least tern (*Sterna antillarum browni*)	FE, SE	Nesting locations in open habitats with sandy substratum around San Diego Bay on dunes and flats, partially developed shoreline areas; nests on NTC, North Island airfield; forages in nearshore waters including northeast side of North Island (Unitt 1984; DON 1992c; DON 1994b).
Short-eared owl (*Asio flammeus*)	CSC (nesting only)	Winter visitor to salt marshes, e.g., Sweetwater Marsh (Unitt 1984; MBA 1990).
Western burrowing owl (*Athene cunicularia hypugea*)	FSC, CSC	Occupies ground squirrel burrows in coastal dune areas; large colony on North Island (DON 1992c).
California horned lark (*Eremophila alpestris actia*)	CSC	Nesting population around San Diego Bay, also a common migrant; nests at NTC, North Island (Unitt 1984).
Loggerhead shrike (*Lanius ludovicianus*)	CSC	Resident of beach and upland areas around San Diego Bay (MBA 1990).
Belding's savannah sparrow (*Passerculus sandwichensis beldingi*)	FSC, SE	Nests in pickleweed salt marshes, including Paradise Creek/Sweetwater Marsh; forages in marshes, coastal strand habitats (MBA 1990; DON 1992c).
Large-billed savannah sparrow (*Passerculus sandwishensis rostratus*)	FSC, CSC	Formerly a winter visitor, not seen recently (Unitt 1984).
Mammals		
San Diego black-tailed jackrabbit (*Lepus californicus bennetti*)	FSC, CSC	Locally common, e.g., near Lindbergh Field, North Island (DON 1992c).
Pacific pocket mouse (*Perognathus longimembris pacificus*)	FE, CSC	Historically present in open coastal scrub along immediate coast of southern California, recently rediscovered (Dana Point, Camp Pendleton); remotely possible in undeveloped areas (USFWS 1994).

Notes: 1. FE = Federally listed as endangered
FT = Federally listed as threatened
FSC = Federal Species of Concern
SE = State listed as endangered
ST = State listed as threatened
CSC = State listed Species of Special Concern
CNPS 1B = California Native Plant Society List 1B, eligible for state listing
2. Under consideration for federal candidate status

SECTION 3.9

NASNI SUPPLEMENTAL TRANSPORTATION INFORMATION

SECTION 3.9
NASNI SUPPLEMENTAL TRANSPORTATION INFORMATION

Ground Transportation

An analysis was conducted to determine the impacts of the net future additional traffic that would be generated by the two additional CVNs. Table 3.9-5 shows the estimated increase in daily traffic volumes on each homeport area roadway segment and the before-and-after volume/capacity ratios. The future traffic volumes without the project were extracted from a draft report prepared by SANDAG titled "San Diego-Coronado Bridge Toll Removal Impact Study" (October 1998) or estimated by applying a 5 percent growth factor to the existing traffic volumes (whichever is higher). The traffic forecasts represent future conditions taking into account projections of population and employment growth in Coronado and the San Diego region. Although the SANDAG forecasts represent the year 2015 and are higher than what would be expected for the year 2005 when a third CVN would be homeported at NASNI, this scenario has been used to represent future conditions to ensure that the level of anticipated growth and the cumulative traffic increases in Coronado have been considered. It has been assumed for the CVN traffic analysis that the bridge tolls would continue to be charged through the year 2005 (Scenario 2 from the SANDAG report). If the toll charges at the bridge were to be eliminated, the traffic forecasts would substantially change, as documented in the SANDAG report.

The impacts of the additional traffic on peak hour levels of service at the home port area intersections are shown on Table 3.9-6. The future intersection conditions without the project are based on traffic forecasts from the SANDAG study. None of the homeport area roadways and intersections would be significantly impacted because the changes in traffic volumes and levels of service are below the significance criteria thresholds.

Table 3.9-7 shows the assumed trip generation characteristics for an aircraft carrier homeported at the various locations. The generated traffic volumes are shown for a CVN and a CV for purposes of comparison. This information was used as input for both the traffic and air quality analyses. The top section of the table shows the assumed trip generation rates and the lower sections of the table show the estimated volumes of site-generated traffic. The daily trip rates for the three west coast locations are based on gate counts, while the rate for Pearl Harbor is an average of the three. The daily traffic volumes represent all vehicles entering and leaving the base, including commuter trips as well as personal off-duty trips, deliveries, maintenance, visitors, recreational trips, etc. The volume of daily commuter trips was calculated by using the assumptions detailed below the table. The 2,992 trips shown in the table represent both directions of travel (i.e., 1,496 inbound and 1,496 outbound) and all different commuting times throughout the day. The peak hour traffic volume of 850 vehicles shown for the three west coast locations is based on information developed for the 1995 EA for a CVN in Puget Sound. The peak hour volumes for Pearl Harbor were developed specifically for the traffic analysis and reflect the unique characteristics of that location.

Table 3.9-8 shows the volume of daily traffic that would be generated by off-base housing. The traffic volumes were estimated by multiplying the number of off-base households by a general trip generation rate from the *Trip Generation* manual (Institute of Transportation Engineers, 6th Edition, 1997). As this manual has data for various types of housing, the average of the trip rates for single-family detached housing and apartments was used. This information has been developed as input to the air quality analysis. The daily trip generation rate shown in the table reflects a

Table 3.9-5. Impact on Daily Traffic Volumes — Facilities for Two Additional CVNs at NASNI

Roadway/Location – Capacity	*Future Traffic Volume - V/C - LOS*	*Project Traffic*	*Traffic Volume w/Project - V/C - LOS*
Coronado Bay Bridge – 65,000			
Average	74,600 - 1.15 – F	150	74,750 - 1.15 – F
Peak Season	83,600 - 1.29 - F	150	83,750 - 1.29 – F
Silver Strand Boulevard – 39,000			
North of NAB	40,000 - 1.03 – F	30	40,030 - 1.03 – F
South of NAB	28,000 - 0.72 - C	30	28,030 - 0.72 – C
First Street – 9,750			
Orange to Alameda	6,600 – 0.68 - B	25	6,625 - 0.68 – B
Third Street (one-way) – 32,500			
C to Orange	30,000 – 0.92 - E	75	30,075 - 0.93 – E
Orange to H	19,100 – 0.59 - A	60	19,160 - 0.59 – A
H to Alameda	17,200 – 0.53 - A	60	17,260 - 0.53 – A
Fourth Street (one-way) – 32,500			
Pomona to C	37,000 – 1.14 – F	75	37,075 - 1.14 – F
C to Orange	37,000 – 1.14 – F	75	37,075 - 1.14 – F
Orange to H	19,100 – 0.59 – A	60	19,160 - 0.59 – A
H to Alameda	18,300 – 0.56 – A	60	18,360 - 0.57 – A
Pomona Avenue (one-way) – 32,500			
Fourth to Third	30,000 – 0.92 - E	75	30,075 - 0.93 – E
Ocean Boulevard – 19,500			
Orange to Alameda	11,700 – 0.60 - B	30	11,730 - 0.60 – B
Alameda to Gate 5	8,200 - 0.42 - A	30	8,230 - 0.42 – A
Orange Avenue			
First to Third – 19,500	12,500 – 0.64 - B	25	12,525 - 0.64 – B
Third to Fourth – 39,500	33,500 – 0.86 - D	15	33,515 - 0.86 – D
Fourth to Eighth – 39,500	38,500 – 0.99 - E	5	38,505 - 0.99 – E
Eighth to Tenth – 39,500	30,000 – 0.77 - C	5	30,005 - 0.77 – C
Tenth to Pomona – 39,500	32,600 – 0.84 - D	5	32,605 - 0.84 – D
Alameda Boulevard			
First to Third – 9,750	4,140 - 0.42 - A	15	4,155 - 0.43 – A
Third to 4th (one-way) – 32,500	21,000 – 0.65 - B	50	21,050 - 0.65 – B
Fourth to Sixth – 19,500	9,960 - 0.51 - A	5	9,965 - 0.51 – A
Sixth to Ocean – 19.500	4,880 - 0.25 - A	5	4,885 - 0.25 – A

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Table 3.9-6. Impact on Intersection Levels of Service — Facilities for Two Additional CVNs at NASNI

	A.M. Peak Hour		P.M. Peak Hour	
	Delay (sec) & V/C Ratio	*LOS*	*Delay (sec) & V/C Ratio*	*LOS*
Orange/First				
W/o Project	14.6 – 0.594	B	12.6 – 0.552	B
W/ Project	14.6 – 0.596	B	12.7 – 0.564	B
Orange/Third				
W/o Project	21.3 – 1.007	C	20.3 – 0.628	C
W/ Project	22.1 – 1.011	C	20.4 – 0.631	C
Orange/Fourth				
W/o Project	29.8 – 0.624	D	66.7 – 1.082	F
W/ Project	29.8 – 0.625	D	69.8 - 1.091	F
Orange/R.H. Dana				
W/o Project	22.0 – 0.788	C	30.8 – 0.858	D
W/ Project	22.1 – 0.791	C	30.9 – 0.860	D
Alameda/Third				
W/o Project	0.3 – N/A	A	6.9 – N/A	B
W/ Project	0.3 – N/A	A	7.1 – N/A	B
Alameda/Fourth				
W/o Project	6.7 – 1.006	B	>120 - 2.624	F
W/ Project	6.7 – 1.006	B	>120 - 2.630	F

Source: SANDAG 1998

reduction of two daily trips per day per household to eliminate the commute trips to and from the base. This avoids double counting of these trips, as they are included in the traffic counts at the bases. It should be noted that the traffic generated by off-base housing was not evaluated in the traffic impact analysis because the specific housing locations are unknown. With regard to the NASNI analysis, it is likely that only a negligible number of off-base residences would be within the city of Coronado.

Table 3.9-7. Generated Traffic Volumes for an Aircraft Carrier

Location	*Total Daily Traffic Volume*	*Daily Commuter Trips (In plus Out)*	*Peak Hour Traffic Volume*
TRIP GENERATION RATES			
NASNI	1.47	See Calculations	0.265
PSNS Bremerton	1.45	See Calculations	0.265
NAVSTA Everett	1.304	See Calculations	0.265
Pearl Harbor	1.41	See Calculations	See Calculations
GENERATED TRAFFIC VOLUME – CVN (3,217 PERSONNEL)			
NASNI	4,730	2,992	850
PSNS Bremerton	4,660	2,992	850
NAVSTA Everett	4,190	2,992	850
Pearl Harbor	4,530	2,992	850 520[1] Total 1,370 [1] PIA Commute
GENERATED TRAFFIC VOLUME – CV (3,115 PERSONNEL)			
NASNI	4,580	2,897	825
PSNS Bremerton	4,520	2,897	825
NAVSTA Everett	4,060	2,897	825
Pearl Harbor	4,390	2,897	825 (No PIA Traffic)

Table 3.9-8. Traffic Generated by Off-Base Residences

Assumption		*Daily Traffic Volume Generated*	
		TRIP GENERATION RATE (TRIPS PER HOUSEHOLD)	TRAFFIC VOLUME (TRIPS PER DAY)
CVN (3,217 total personnel) Married E-5 and below Married/Unmarried E-6 and up Total	 1,104 708 1,812	6.1	11,050
CV (3,115 total personnel) Married E-5 and below Married/Unmarried E-6 and up Total	 1,069 686 1,755	6.1	10,700

Calculations for Daily Commuter Trips:

3,217 total personnel, including 708 E-6 and up (all commuters) and 2,509 E-5 or below, of which 44 percent are married and commute.

708 + 2,509 x 0.44 = 1,812 off-base personnel

1,812 x 0.9 (absent)/1.09 (auto occupancy) = 1,496 commuters/day x 2 directions = 2,992

The CV traffic is calculated the same, but using 3,115 personnel instead of 3,217.

Calculations for Peak Hour Trips at Pearl Harbor:

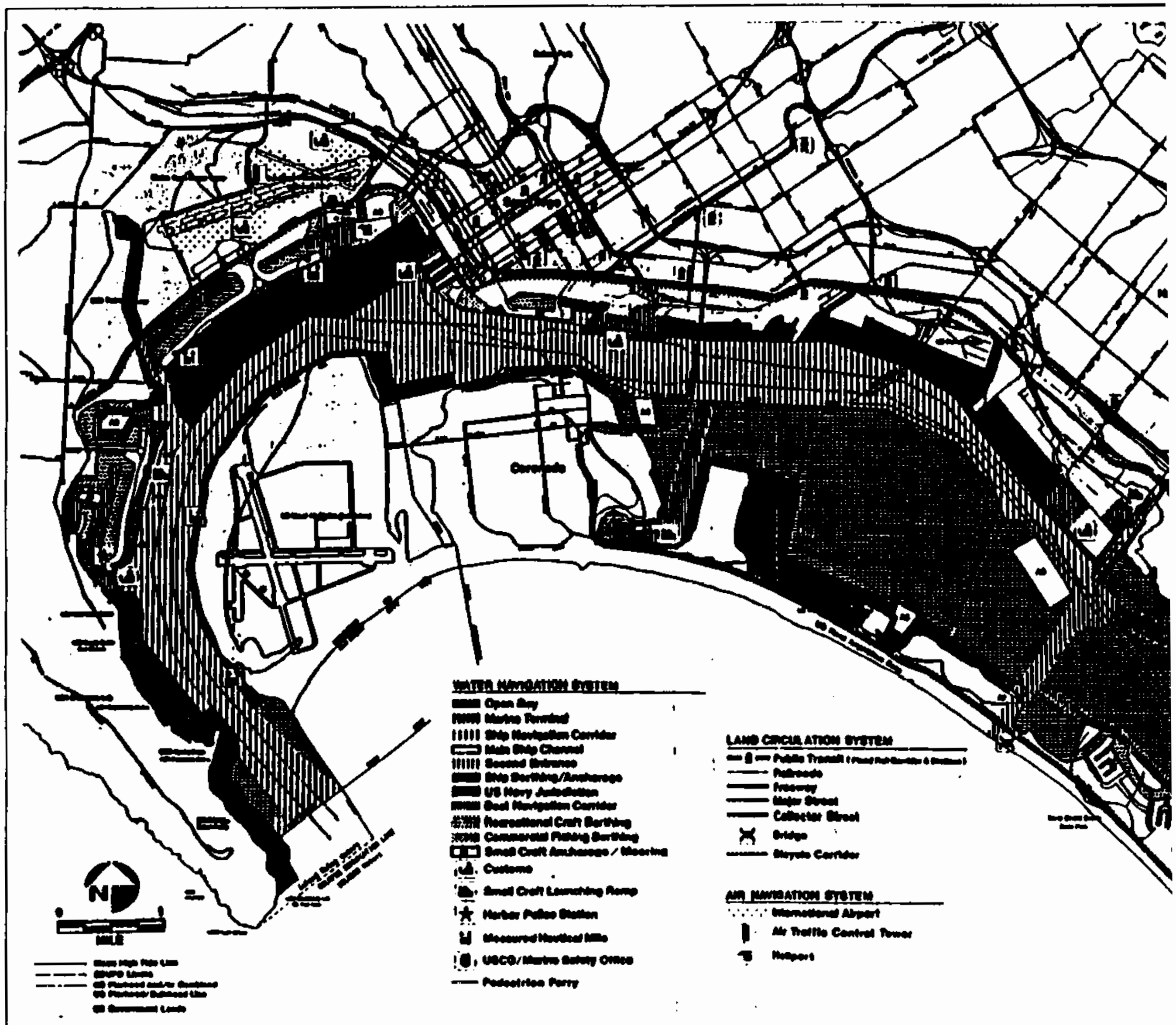
850 CVN trips + 1,300 PIA workers / 2.5 workers per vehicle = 1,370 trips

Vessel Transportation

Key elements of the water navigation system include the open bay, marine terminal, ship navigation corridor, main ship channel, U.S. Navy ship berthing/anchorage, restricted areas, boat navigation corridor, recreational craft berthing, commercial fishing berthing, and small craft anchorage/mooring. A ship navigation corridor extends from the mouth of the bay to the National City limit. The navigation corridor provides access to marine terminals, marine-related industrial areas, and military bases. The purpose of the ship navigation channel is to provide adequate draft for ship maneuverability, safe transit, and access to marine terminals, marine related industrial areas, and military bases. Pursuant to the Port Master Plan (SDUPD, amended in 1993), ship corridors are maintained at adequate depths and widths to eliminate hazardous conflicts in the harbor among ships, small craft, and structures. Further, aquatic activities incompatible with vessel traffic in marked ship and boat channels and restricted areas are prohibited.

Marine vessel circulation in the bay is regulated by the U.S. Coast Guard navigational standards and other general navigational standards, which are enforced by the San Diego Harbor Police. Compliance with the International Rules of the Road for lighting and day markers is also required. These are general standards, however, and do not comprise a formal marine traffic system for large vessels.

Navigation in San Diego Bay is shown in Figure 3.9-1. The main ship channel, which is maintained by the U.S. Army Corps of Engineers, provides a depth of -47 feet mean lower low water (MLLW) and a width that ranges from 600 to 2,000 feet from the bay's entrance to berthing areas on North Island; a –47-foot MLLW depth and varying widths from 600 to 1,900 feet to the Tenth Avenue Marine Terminal; and a –37-foot MLLW depth and a width varying from 600 to 1,350 feet down the bay to the National City Marine Terminal (SDUPD 1992). Naval vessels, including cruisers and amphibious assault ships, can sail as far south as NAVSTA. The San Diego-Coronado Bay Bridge has three major spans over the bay that affect navigation. Two of the spans are over the navigation channel and have vertical clearances of 195 feet at mean high water (MHW) and clear widths of 600 feet. The last span is located at the pierhead line and provides



SOURCE: Port Master Plan 1992

Figure 3.9-1. Circulation and Navigation in San Diego Bay

vertical clearance of 175 feet at MHW and a clear width of 500 feet (SDUPD 1992). Ship anchorage areas are also shown in Figure 3.9-1.

Boat navigation corridors range from 6 to 21 feet in depth and provide access to the more remote areas of the bay. Boat navigation corridors are those water areas delineated by navigational channel markers or by conventional waterborne traffic movements. Boat corridors are designated by their predominant traffic and general physical characteristics. These channels are generally too shallow and too narrow to accommodate larger ships.

The remaining areas of the open bay are quite shallow, ranging in depth from 2 to 17 feet. These areas comprise a large portion of the bay. Shallow draft sailboats and power boats use these areas for recreation and travel.

Uncontrolled boat anchorage is allowed in the open areas of the bay except where otherwise prohibited by other uses. Ship anchorage areas for ocean-going ships are located primarily in the area north of the "B" Street Pier but include all of the navigable waters of the harbor except designated channels, cable and pipeline areas, special anchorages, and Naval Restricted Areas. Vessels anchoring in portions of the harbor, other than the areas discussed above, leave a free passage for other craft and are prohibited from unreasonably obstructing vessel approaches to the wharves in the harbor.

SECTION 3.10

NASNI SUPPLEMENTAL AIR QUALITY INFORMATION

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NASNI SUPPLEMENTAL AIR QUALITY INFORMATION

The Eastern Pacific High is a persistent anticyclone that attains its greatest strength and most northerly position during summer, when it is centered west of northern California. In this position, the High effectively shelters southern California from the effects of polar storm systems. As winter approaches, the Eastern Pacific High weakens and shifts to the south, allowing polar storm systems to pass through the region. Subsiding air associated with the High warms the upper levels of the atmosphere and produces an elevated temperature inversion (temperature increases with height) along the west coast. The base of this temperature inversion is generally from 1,000 to 3,000 feet above mean sea level during the summer. The subsidence inversion acts like a lid on the lower atmosphere and traps air pollutants near the surface of the earth by limiting vertical dispersion. Mountain ranges in eastern San Diego County constrain the horizontal movement of air and also inhibit the ventilation of air pollutants out of the region. These two factors, combined with the emission sources of over three million people, help to create the high pollutant conditions sometimes experienced in San Diego County. Table 3.10-1 provides ambient air quality standards for California and the United States.

Concurrent with the presence of the Eastern Pacific High, a thermal low pressure system persists in the interior desert region due to intense insulation. The resulting pressure gradient between these two systems produces a westerly, onshore air flow in San Diego County for most of the year. Sea breezes usually occur during the daytime and help to disperse air pollutants toward the interior regions. During the evening hours and colder months of the year, sea breezes are often replaced by land breezes that blow in the opposite direction toward the offshore areas. These weak offshore flows may continue until daytime heating reverses the flow back onshore.

During colder months, the Eastern Pacific High often combines with high pressure over the continent to produce extended periods of light winds and low-level inversion conditions in the region. These atmospheric conditions frequently produce adverse air quality. Excessive build-up of high pressure over the continent can produce a "Santa Ana" condition, characterized by warm, dry, northeast winds. Santa Ana winds help to ventilate the air basin of locally generated emissions. However, Santa Ana conditions can also transport air pollutants from the Los Angeles metropolitan area into the region. When stagnant atmospheric conditions occur in the region during a Santa Ana, local emissions, combined with pollutants transported from the Los Angeles metropolitan area, can lead to significant O_3 impacts in the project area.

The 1998 emissions for existing conditions at NASNI includes the presence of two homeported carriers averaged over the annual period: one conventionally powered carrier (CV) for the entire year, one CV for six months of the year, and one nuclear-powered carrier (CVN) for six months of the year. Table 3.10-2 provides a summary of the 1998 existing criteria pollutant emissions associated with homeported carriers at NASNI. Table 3.10-3 provides an estimate of annual air emissions associated with the construction of project alternatives at NASNI. Tables 3.10-4 through 3.10-71 present a summary of air emissions associated with the construction and operation of the project alternatives at NASNI.

Table 3.10-1. National and California Ambient Air Quality Standards

Pollutant	*Averaging Time*	*California Standards*	National Standards [a]: *Primary* [b,c]	National Standards [a]: *Secondary* [b,d]
Ozone[e]	8-hour	—	0.08 ppm (160 $\mu g/m^3$)	Same as primary
	1-hour	0.09 ppm (180 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	Same as primary
Carbon monoxide	8-hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	—
	1-hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	—
Nitrogen dioxide	Annual	—	0.053 ppm (100 $\mu g/m^3$)	Same as primary
	1-hour	0.25 ppm (470 $\mu g/m^3$)	—	—
Sulfur dioxide	Annual	—	0.03 ppm (80 $\mu g/m^3$)	—
	24-hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	—
	3-hour	—	—	0.5 ppm (1,300 $\mu g/m^3$)
	1-hour	0.25 ppm (655 $\mu g/m^3$)	—	—
PM_{10}	Annual (arithmetic mean)	—	50 $\mu g/m^3$	Same as primary
	Annual (geometric mean)	30 $\mu g/m^3$	—	—
	24-hour	50 $\mu g/m^3$	150 $\mu g/m^3$	Same as primary
$PM_{2.5}$[f]	Annual (arithmetic)	—	15 $\mu g/m^3$	Same as primary
	24-hour	—	65 $\mu g/m^3$	Same as primary
Lead	Calendar quarter	—	1.5 $\mu g/m^3$	Same as primary
	30-day average	1.5 $\mu g/m^3$	—	—

Notes:
(a) Standards, other than for ozone and those based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.
(b) Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parenthesis.
(c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each state must attain the primary standards no later than 3 years after that states implementation plan is approved by the EPA.
(d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
(e) The 8-hour ozone standard was promulgated in 1997, and will replace the 1-hour standard. However, the 1-hour standard will continue to apply to areas not attaining it for an interim period.
(f) The $PM_{2.5}$ standard (particulate matter with a 2.5 micron diameter) will be implemented over an extended time frame. Areas will not be designated as in attainment or nonattainment of this standard until the 2002-2005 time frame.

Table 3.10-2. Summary of Annual Existing Air Emissions at NAS North Island for Homeported Carriers -Year 1998

Vessel Group/Source Type	AIR POLLUTANT EMISSIONS (Tons/year)				
	VOC	CO	NO_x	SO_x	PM_{10}
Two CVs					
Main Power Plants - Boilers	3.3	16.7	91.5	100.5	18.5
Onboard Emergency Diesel Generators	0.5	1.1	5.1	0.4	0.5
Onshore Infrastructure	13.7	0.0	0.2	0.0	0.0
Routine Vessel Maintenance	4.0	0.0	0.0	0.0	0.0
On-road Vehicles	28.1	307.1	55.5	0.0	0.8
TOTAL – 2 CVs	**49.6**	**324.9**	**152.3**	**100.9**	**19.8**
One CVN					
Onboard Emergency Diesel Generators	0.2	0.9	4.2	0.3	0.3
Onshore Infrastructure	3.3	0.0	0.0	0.0	0.0
Routine Vessel Maintenance	1.3	0.0	0.0	0.0	0.0
PIA Maintenance	15.00	0.0	0.0	0.0	3.0
On-road Vehicles	9.7	105.8	19.1	0.0	0.2
TOTAL – 1 CVN	**29.5**	**106.7**	**23.3**	**0.3**	**3.5**
TOTAL 2CVs + 1CVN (1)	**79.1**	**431.6**	**175.6**	**101.2**	**23.3**

Note: (1) Represents emissions from 1 CV for 1 year, 1 CV for 6 months, and 1 CVN for 6 months.

Table 3.10-3. 1997 Annual Toxic Air Contaminant Emissions Inventory for NASNI.

Compound	Facility-wide Emissions (Pounds/Year)
1,1,1-Trichloroethane	339.0
1,3-Butadiene	29.7
2,2,4-Trimethylpentane	122.3
Acetaldehyde	12.8
Acetone	1,093.8
Acrolein	0.8
Acrylonitrile	3.0
Aluminum	255.6
Ammonia	167.7
Arsenic and Compounds	2.4
Barium and Compounds	201.0
Benzene	764.2
Benzo[a]Anthracene	0.0
Benzo[a]Pyrene	<0.01
Benzo[b]Fluoranthene	<0.01
Benzo[k]Fluoranthene	<0.01
Butanol (Butyl Alcohol)	9,836.3
Cadmium	1.8
Carbon Disulfide	0.4
Carbonyl Sulfide	0.3
Chlorobenzenes	0.3
Chlorofluorocarbons	4,305.4
Chloroform	0.0
Chromium (Hexavalent)	7.6
Chromium Compounds (Not Hexavalent)	19.0
Cobalt	0.0
Copper and Compounds	4.2
Dibenzo[a,h]Anthracene	<0.01
Dichlorobenzene	4.5
Dimethyl Sulfide	4.3
Ethylbenzene	339.2
Ethylene Dichloride	43.1
Ethylene Glycol Butyl Ether	993.8
Formaldehyde	65.8
Glycol Ethers (Not Otherwise Listed)	7,151.0
Hexane	934.4
Hydrochlorofluorocarbons	35.2
Hydrogen Sulfide	10.8
Indeno(1,2,3-cd)Pyrene	<0.01
Isopropyl Alcohol	6,271.0
Lead and Compounds	18.1
Manganese and Compounds	26.2
Mercury and Compounds	0.7
Methanol	215.4
Methyl Ethyl Ketone	7,806.6
Methyl Isobutyl Ketone	10,169.1
Methyl Tert Butyl Ether	2,033.8
Methylene Chloride	26,230.1
Naphthalene	68.8
Nickel and Compounds	17.2
Polycyclic Aromatic Hydrocarbons, Unspecified	1.3
Perchloroethylene	19.6
Phenol	5,397.8
Propylene	116.2
Selenium and Compounds	3.0
Silica, Crystalline	155.1
Thallium	4.9
Toluene	2,517.8
Trichloroethylene	159.3
Vinyl Chloride	4.1
Vinylidene Chloride	0.2
Xylenes	12,042.8

Table 3.10-4. Annual Construction Emissions for the CVN Homeporting Project at NASNI - Scenario One - Clamshell/Hydraulic Dredge and Disposal Option.

	Tons per Year				
Year/Construction Activity	*VOC*	*CO*	*NOx*	*SOx*	*PM10*
Year 1					
Dike Construction	0.6	7.1	4.7	0.7	0.2
Mitigation Site Dredging and Disposal	0.4	1.9	3.6	0.3	0.4
Turning Basin Dredging and Disposal (1)	1.2	9.8	32.5	4.0	1.2
Annual Total	**2.1**	**18.9**	**40.8**	**5.0**	**1.8**
Year 2					
CVN Berth Construction (2)	2.5	16.2	23.9	2.2	1.5
Annual Total	**2.5**	**16.2**	**23.9**	**2.2**	**1.5**
Peak Year (3)	**2.5**	**18.9**	**40.8**	**5.0**	**1.8**

Note: (1) NOx emissions from stationary sources reduced by 20% to represent compliance with SDCAPCD BACT requirements.

(2) Emissions equal to those estimated for wharf construction associated with the BRAC CVN Project (DON 1995a).

(3) Peak annual emissions would occur during the first year of construction, except for VOC emissions.

Table 3.10-5. Annual Construction Emissions for the CVN Homeporting Project at NASNI - Scenario Two - Sidecasting Clamshell/Hydraulic Dredge and Disposal Option .

	Tons per Year				
Year/Construction Activity	*VOC*	*CO*	*NOx*	*SOx*	*PM10*
Year 1					
Dike Construction	0.6	7.1	4.7	0.7	0.2
Mitigation Site Dredging and Disposal	0.4	1.9	3.6	0.3	0.4
Turning Basin Dredging and Disposal (1)	1.3	12.4	38.1	4.4	1.5
Annual Total	**2.3**	**21.4**	**46.3**	**5.4**	**2.1**
Year 2					
CVN Berth Construction (2)	2.5	16.2	23.9	2.2	1.5
Annual Total	**2.5**	**16.2**	**23.9**	**2.2**	**1.5**
Peak Year (3)	**2.5**	**21.4**	**46.3**	**5.4**	**2.1**

Note: (1) NOx emissions from stationary sources reduced by 20% to represent compliance with SDCAPCD BACT requirements.

(2) Emissions equal to those estimated for wharf construction associated with the BRAC CVN Project (DON 1995a).

(3) Peak annual emissions would occur during the first year of construction, except for VOC emissions.

Table 3.10-6. Annual Construction Emissions for the CVN Homeporting Project at NASNI - Scenario Three - Clamshell Dredge and Disposal Option.

Year/Construction Activity	*Tons per Year*				
	VOC	*CO*	*NOx*	*SOx*	*PM10*
Year 1					
Dike Construction	0.6	7.1	4.7	0.7	0.2
Mitigation Site Dredging and Disposal	0.4	1.9	3.6	0.3	0.4
Turning Basin Dredging and Disposal (1)	1.9	13.8	51.4	6.9	1.8
Annual Total	**2.9**	**22.9**	**59.6**	**7.9**	**2.4**
Year 2					
CVN Berth Construction (2)	2.5	16.2	23.9	2.2	1.5
Annual Total	**2.5**	**16.2**	**23.9**	**2.2**	**1.5**
Peak Year (3)	**2.9**	**22.9**	**59.6**	**7.9**	**2.4**

Note: (1) NOx emissions from stationary sources reduced by 20% to represent compliance with SDCAPCD BACT requirements.

(2) Emissions equal to those estimated for wharf construction associated with the BRAC CVN Project (DON 1995a).

(3) Peak annual emissions would occur during the first year of construction.

Table 3.10-7. Emission Source Data for Dike Construction at the Piers J/K CVN Berth.

Construction Activity/ Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Dredge Dike Footing with Clamshell (1)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	24	66	48,470
Dredge - Main Generator	900	0.50	1	450	23.0	24	66	36,353
Dredge - Deck Generator	240	0.60	1	144	7.3	5	66	2,424
Tug Boat	800	0.20	1	160	8.0	4	66	2,112
Disposal to CAD-1 (2)								
Tug Boat	2,200	0.60	1	1,320	66.0	4.0	66	17,424
Rock Placement - Barge Dump (3)								
Tug Boat - Transport (4)	2,200	0.60	2	2,640	132.0	3.5	20	9,240
Tug Boat - Rock Dumping	2,200	0.20	2	880	44.0	1.0	20	880
Rock Placement - Clamshell (5)								
Tug Boat - Transport (4)	2,200	0.60	2	2,640	132.0	3.5	7	3,234
Tug Boat - Rock Unloading	2,200	0.10	2	440	22.0	4.0	7	616
Dredge - Main Hoist	1,200	0.50	1	600	30.6	8	7	1,714
Dredge - Main Generator	900	0.50	1	450	23.0	8	7	1,285
Dredge - Deck Generator	240	0.60	1	144	7.3	2	7	103
Dike Filling								
Bulldozer - D6	140	0.60	1	84	4.3	8	60	2,056
Sweeper Truck	175	0.50	1	88	9.7	4	80	3,108
Vibratory Roller	140	0.60	1	84	4.3	6	60	1,542
Water Truck	175	0.50	1	88	4.5	4	80	1,428

Notes: (1) Based on a daily dredging rate of 3,333 cubic yards (cy), or 4,000 cy with a 1.2 bulk factor. Total dredging volume for the dike foolting would be 220,000 cy, or 264,000 cy with a 1.2 bulk factor.

(2) Based on a daily disposal rate of 4,000 cy (bulked), or two barge loads. Total disposal volume of 264,000 cy (bulked).

(3) Based on a daily/total placement rate of 6,000/118,500 tons.

(4) Barge capacity would be 3,000 tons. Operations beyond the 3 nm State Waters Boundary not included.

(5) Based on a daily/total placement rate of 6,000/39,500 tons.

Table 3.10-8. Emission Source Data for Construction of the Mitigation Site at Pier B - NASNI.

Construction Activity/ Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Sediment Removal (1)								
Excavator - Cat 235	250	0.50	1	125	6.4	8	80	4,080
Excavator - Cat 245	360	0.50	1	180	9.2	8	80	5,875
Bulldozer - D6	140	0.60	1	84	4.3	8	80	2,742
Loader - 966	200	0.20	1	40	2.0	8	80	1,280
Dump Truck - 15 cu yds (2)	NA	NA	11	NA	NA	40	80	35,200

Notes: (1) Based on a daily/total removal rate of 600/48,000 cy.

(2) Number Active are miles/round trip(between Pier B and Piers J/K), Hours/Day are the daily trips, and Annual Hp-Hrs are annual miles.

Table 3.10-9. Emission Source Data Associated with Hydraulic Dredging and Disposal Activities at NASNI Piers J/K - CVN Homeporting Project.

Construction Activity/ Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Hydraulic Dredging (1)								
Generator	1,500	0.80	2	2,400	122.4	24	16	47,002
Tender Vessel	400	0.40	1	160	8.0	2	16	256
Survey Vessel	100	0.40	1	40	2.0	2	16	64
Runabout Vessel	60	0.40	1	24	1.2	2	16	38
Disposal at CAD-1								
Booster Pump	2,000	0.80	1	1,600	80.0	24	16	30,720
Tender Vessel	400	0.40	1	160	8.0	6	16	768

Notes: (1) Based on a daily/total dredging rate of 20,000/314,000 cy, dry.

Table 3.10-10. Emission Factors for Dredging/Disposal Activities at NASNI for the CVN Homeporting Project.

Equipment Type	*Fuel Type*	*Pounds/1000 Gallons (1)*						*Source*
		VOC	*CO*	*NOx*	*SO2*	*PM*	*PM10*	
Stationary Engines >600 Hp	D	11.1	111.0	424.8	39.5	13.6	13.3	(1)
Stationary Engines <600 Hp	D	43.3	129.3	600.2	39.5	42.2	41.4	(2)
Tug Boats	D	19.0	57.0	419.0	75.0	9.0	8.8	(3)
Dozer	D	1.5	4.8	10.3	0.9	1.1	1.1	(4)
Excavator	D	0.9	5.2	10.8	0.9	1.4	1.4	(4)
Sweeper Truck	G	9.1	199.0	5.2	0.3	0.1	0.1	(4)
Vibratory Roller	D	1.0	3.1	9.3	1.0	0.8	0.8	(4)
Water Truck	D	1.1	2.8	9.6	0.9	0.8	0.8	(4)
Loader	D	1.1	4.8	10.3	0.9	1.3	1.3	(4)
Dump Trucks - 25 MPH	D	1.5	10.0	9.3	0.6	0.6	0.6	(5)
Power - Inboard	D	51.6	81.5	380.0	26.9	24.0	23.0	(6)
Power - Inboard	G	145.6	2676.0	101.0	6.4	1.6	1.6	(6)

Notes: (1) AP-42, Table 3.4-1, Vol. I (EPA 1996).

(2) AP-42, Table 3.3-1, Vol. I (EPA 1996).

(3) Lloyd's Register of Shipping, London 1990, 1993, and 1995. From Acurex Env. Corp. 1996.

(4) Non-Road Engine and Vehicle Emission Study Report (EPA 1991), units in grams/hp-hr.

(5) From EMFAC7G (ARB 1997), units in grams/mile.

(6) Development of an Improved Inventory of Emissions from Pleasure Craft in California (ARB 1995).

Table 3.10-11. Emissions for Dike Construction at the Piers J/K CVN Berth - CVN Homeporting Project.

Construction Activity/Equipment Type	Tons					
	VOC	CO	NOx	SO2	PM	PM10
Dredge Dike Footing with Clamshell (1)						
Dredge - Main Hoist (1)	0.3	2.7	8.2	1.0	0.3	0.3
Dredge - Main Generator (1)	0.2	2.0	6.2	0.7	0.2	0.2
Dredge - Deck Generator (1)	0.1	0.2	0.6	0.0	0.1	0.1
Tug Boat	0.0	0.1	0.4	0.1	0.0	0.0
Disposal to CAD-1						
Tug Boat Transport	0.2	0.5	3.7	0.7	0.1	0.1
Rock Placement - Barge Dump						
Tug Boat Transport (2)	0.1	0.3	1.9	0.3	0.0	0.0
Tug Boat - Rock Dumping	0.0	0.0	0.2	0.0	0.0	0.0
Rock Placement - Clamshell						
Tug Boat Transport (2)	0.0	0.1	0.7	0.1	0.0	0.0
Tug Boat - Rock Unloading	0.0	0.0	0.1	0.0	0.0	0.0
Dredge - Main Hoist (1)	0.0	0.1	0.3	0.0	0.0	0.0
Dredge - Main Generator (1)	0.0	0.1	0.2	0.0	0.0	0.0
Dredge - Deck Generator (1)	0.0	0.0	0.0	0.0	0.0	0.0
Dike Filling						
Bulldozer - D6	0.1	0.2	0.5	0.0	0.0	0.0
Sweeper Truck	0.3	6.1	0.2	0.0	0.0	0.0
Vibratory Roller	0.0	0.1	0.3	0.0	0.0	0.0
Water Truck	0.0	0.1	0.3	0.0	0.0	0.0
Total Emissions - Tons	**1.3**	**12.5**	**23.8**	**3.2**	**0.9**	**0.9**
Total Diking Emissions	**0.6**	**7.1**	**4.7**	**0.7**	**0.2**	**0.2**
Total Dredging/Disposal Emissions	**0.7**	**5.4**	**19.1**	**2.5**	**0.7**	**0.7**

Note: (1) NOx emissions from stationary sources reduced by 20% to represent compliance with SDCAPCD BACT requirements.

(2) Does not include emissions that would occur beyond the 3-mile State Waters boundary.

Table 3.10-12. Emissions for Construction of the Pier B Mitigation Site - CVN Homeporting Project.

	Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Land-based Sediment Removal						
Excavator - Cat 235	0.1	0.5	0.9	0.1	0.1	0.1
Excavator - Cat 245	0.1	0.7	1.4	0.1	0.2	0.2
Bulldozer - D6	0.1	0.3	0.6	0.1	0.1	0.1
Loader - 966	0.0	0.1	0.3	0.0	0.0	0.0
Dump Truck - 15 cu yd loads	0.1	0.4	0.4	0.0	0.0	0.0
Total Emissions - Tons	**0.4**	**1.9**	**3.6**	**0.3**	**0.4**	**0.4**

Table 3.10-13. Emissions for Hydraulic Dredging and Disposal Activities at NASNI Piers J/K - CVN Homeporting Project.

	Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Hydraulic Dredging						
Generator (1)	0.26	2.61	7.99	0.93	0.32	0.31
Tender Vessel	0.01	0.01	0.05	0.00	0.00	0.00
Survey Vessel	0.00	0.00	0.01	0.00	0.00	0.00
Runabout Vessel	0.00	0.05	0.00	0.00	0.00	0.00
Disposal at CAD-1						
Booster Pump (1)	0.17	1.70	5.22	0.61	0.21	0.20
Tender Vessel	0.02	0.03	0.15	0.01	0.01	0.01
Total Emissions - Tons	**0.46**	**4.41**	**13.42**	**1.55**	**0.54**	**0.53**
Total Emissions - Use of Electric Dredge/BoosterP (2)	**0.03**	**0.10**	**0.21**	**0.01**	**0.01**	**0.01**

Note: (1) NOx emissions from stationary sources reduced by 20% to represent compliance with SDCAPCD BACT requirements.

Table 3.10-14. Emission Source Data for Dike Construction of the Homeporting Project Piers J/K CVN Berth - Sidecasting Option.

Construction Activity/ Equipment Type	Power Rating (Hp)	Load Factor	# Active	Hourly Hp-Hrs	Fuel Use (Gal/Hr)	Hours Per Day	Total Work Days	Total Fuel Use
Dredge Dike Footing with Clamshell (1)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	24	66	48,470
Dredge - Main Generator	900	0.50	1	450	23.0	24	66	36,353
Dredge - Deck Generator	240	0.60	1	144	7.3	5	66	2,424
Tug Boat	800	0.20	1	160	8.0	4	66	2,112
Rock Placement - Barge Dump (2)								
Tug Boat - Transport (3)	2,200	0.60	2	2,640	132.0	3.5	20	9,240
Tug Boat - Rock Dumping	2,200	0.20	2	880	44.0	1.0	20	880
Rock Placement - Clamshell (4)								
Tug Boat - Transport (3)	2,200	0.60	2	2,640	132.0	3.5	7	3,234
Tug Boat - Rock Unloading	2,200	0.10	2	440	22.0	4.0	7	616
Dredge - Main Hoist	1,200	0.50	1	600	30.6	8	7	1,714
Dredge - Main Generator	900	0.50	1	450	23.0	8	7	1,285
Dredge - Deck Generator	240	0.60	1	144	7.3	2	7	103
Dike Filling								
Bulldozer - D6	140	0.60	1	84	4.3	8	60	2,056
Sweeper Truck	175	0.50	1	88	9.7	4	80	3,108
Vibratory Roller	140	0.60	1	84	4.3	6	60	1,542
Water Truck	175	0.50	1	88	4.5	4	80	1,428

Notes: (1) Based on a daily dredging rate of 3,333 cubic yards (cy), or 4,000 cy with a 1.2 bulk factor. Total dredging volume for the dike footing would be 220,000 cy, or 264,000 cy with a 1.2 bulk factor.

(2) Based on a daily/total placement rate of 6,000/118,500 tons.

(3) Barge capacity would be 3,000 tons. Operations beyond the 3 nm State Waters Boundary not included.

(4) Based on a daily/total placement rate of 6,000/39,500 tons.

Table 3.10-15. Emission Source Data for Hydraulic Dredging and Disposal Activities for the NASNI Homeporting Project Piers J/K CVN Berth - Sidecasting Option.

Construction Activity/ Equipment Type	Power Rating (Hp)	Load Factor	# Active	Hourly Hp-Hrs	Fuel Use (Gal/Hr)	Hours Per Day	Total Work Days	Total Fuel Use
Hydraulic Dredging (1)								
Generator	1,500	0.80	2	2,400	122.4	24	27	79,315
Tender Vessel	400	0.40	1	160	8.0	2	27	432
Survey Vessel	100	0.40	1	40	2.0	2	27	108
Runabout Vessel	60	0.40	1	24	1.2	2	27	65
Disposal at CAD-1								
Booster Pump	2,000	0.80	1	1,600	80.0	24	27	51,840
Tender Vessel	400	0.40	1	160	8.0	6	27	1,296

Notes: (1) Based on a daily/total dredging rate of 20,000/534,000 cy, dry.

Table 3.10-16. Emissions for Dike Construction at the Piers J/K CVN Berth - CVN Homeporting Project.

	Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Dredge Dike Footing with Clamshell (1)						
Dredge - Main Hoist (1)	0.3	2.7	8.2	1.0	0.3	0.3
Dredge - Main Generator (1)	0.2	2.0	6.2	0.7	0.2	0.2
Dredge - Deck Generator (1)	0.1	0.2	0.6	0.0	0.1	0.1
Tug Boat	0.0	0.1	0.4	0.1	0.0	0.0
Rock Placement - Barge Dump						
Tug Boat Transport (2)	0.1	0.3	1.9	0.3	0.0	0.0
Tug Boat - Rock Dumping	0.0	0.0	0.2	0.0	0.0	0.0
Rock Placement - Clamshell						
Tug Boat Transport (2)	0.0	0.1	0.7	0.1	0.0	0.0
Tug Boat - Rock Unloading	0.0	0.0	0.1	0.0	0.0	0.0
Dredge - Main Hoist (1)	0.0	0.1	0.3	0.0	0.0	0.0
Dredge - Main Generator (1)	0.0	0.1	0.2	0.0	0.0	0.0
Dredge - Deck Generator (1)	0.0	0.0	0.0	0.0	0.0	0.0
Dike Filling						
Bulldozer - D6	0.1	0.2	0.5	0.0	0.0	0.0
Sweeper Truck	0.3	6.1	0.2	0.0	0.0	0.0
Vibratory Roller	0.0	0.1	0.3	0.0	0.0	0.0
Water Truck	0.0	0.1	0.3	0.0	0.0	0.0
Total Emissions - Tons	**1.1**	**12.0**	**20.1**	**2.5**	**0.8**	**0.8**
Total Diking Emissions	**0.6**	**7.1**	**4.7**	**0.7**	**0.2**	**0.2**
Total Dredging/Disposal Emissions	**0.5**	**4.9**	**15.4**	**1.8**	**0.6**	**0.6**

Note: (1) NOx emissions reduced by 20% to represent implementation of BACT through the SDCAPCD air permit requirements.

(2) Does not include emissions that would occur beyond the 3-mile State Waters boundary.

Table 3.10-17. Emissions for Construction of the Pier B Mitigation Site - CVN Homeporting Project.

Construction Activity/Equipment Type	Tons					
	VOC	CO	NOx	SO2	PM	PM10
Land-based Sediment Removal						
Excavator - Cat 235	0.1	0.5	0.9	0.1	0.1	0.1
Excavator - Cat 245	0.1	0.7	1.4	0.1	0.2	0.2
Bulldozer - D6	0.1	0.3	0.6	0.1	0.1	0.1
Loader - 966	0.0	0.1	0.3	0.0	0.0	0.0
Dump Truck - 15 cu yd loads	0.1	0.4	0.4	0.0	0.0	0.0
Total Emissions - Tons	**0.4**	**1.9**	**3.6**	**0.3**	**0.4**	**0.4**

Table 3.10-18. Emissions for Hydraulic Dredging and Disposal Activities at NASNI Piers J/K - CVN Homeporting Project.

Construction Activity/Equipment Type	Tons					
	VOC	CO	NOx	SO2	PM	PM10
Hydraulic Dredging						
Generator (1)	0.4	4.4	13.5	1.6	0.5	0.5
Tender Vessel	0.0	0.0	0.1	0.0	0.0	0.0
Survey Vessel	0.0	0.0	0.0	0.0	0.0	0.0
Runabout Vessel	0.0	0.1	0.0	0.0	0.0	0.0
Disposal at CAD-1						
Booster Pump (1)	0.3	2.9	8.8	1.0	0.4	0.3
Tender Vessel	0.0	0.1	0.2	0.0	0.0	0.0
Total Emissions - Tons	**0.8**	**7.4**	**22.6**	**2.6**	**0.9**	**0.9**
Total Emissions - Use of Electric Dredge/BPump	**0.1**	**0.2**	**0.4**	**0.0**	**0.0**	**0.0**

Note: (1) NOx emissions reduced by 20% to represent implementation of BACT through the SDCAPCD air permit requirements.

Table 3.10-19. Emission Source Data for Dike Construction at the Piers J/K CVN Berth.

Construction Activity/ Equipment Type	Power Rating (Hp)	Load Factor	# Active	Hourly Hp-Hrs	Fuel Use (Gal/Hr)	Hours Per Day	Total Work Days	Total Fuel Use
Dredge Dike Footing with Clamshell (1)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	24	66	48,470
Dredge - Main Generator	900	0.50	1	450	23.0	24	66	36,353
Dredge - Deck Generator	240	0.60	1	144	7.3	5	66	2,424
Tug Boat	800	0.20	1	160	8.0	4	66	2,112
Disposal at LA-5 (2)								
Tug Boat	2,200	0.60	1	1,320	66.0	6.3	66	27,443
Rock Placement - Barge Dump (3)								
Tug Boat - Transport (4)	2,200	0.60	2	2,640	132.0	3.5	20	9,240
Tug Boat - Rock Dumping	2,200	0.20	2	880	44.0	1.0	20	880
Rock Placement - Clamshell (5)								
Tug Boat - Transport (4)	2,200	0.60	2	2,640	132.0	3.5	7	3,234
Tug Boat - Rock Unloading	2,200	0.10	2	440	22.0	4.0	7	616
Dredge - Main Hoist	1,200	0.50	1	600	30.6	8	7	1,714
Dredge - Main Generator	900	0.50	1	450	23.0	8	7	1,285
Dredge - Deck Generator	240	0.60	1	144	7.3	2	7	103
Dike Filling								
Bulldozer - D6	140	0.60	1	84	4.3	8	60	2,056
Sweeper Truck	175	0.50	1	88	9.7	4	80	3,108
Vibratory Roller	140	0.60	1	84	4.3	6	60	1,542
Water Truck	175	0.50	1	88	4.5	4	80	1,428

Notes: (1) Based on a daily dredging rate of 3,333 cubic yards (cy), or 4,000 cy with a 1.2 bulk factor. Total dredging volume for the dike footing would be 220,000 cy, or 264,000 cy with a 1.2 bulk factor.

(2) Based on a daily disposal rate of 4,000 cy (bulked), or two barge loads. Total disposal volume of 264,000 cy (bulked).

(3) Based on a daily/total placement rate of 6,000/118,500 tons.

(4) Barge capacity would be 3,000 tons. Operations beyond the 3 nm State Waters Boundary not included.

(5) Based on a daily/total placement rate of 6,000/39,500 tons.

Table 3.10-20. Emission Source Data Associated with Berth/Channel Dredging and Disposal Activities at NASNI Piers J/K - CVN Homeporting Project.

Construction Activity/ Equipment Type	Power Rating (Hp)	Load Factor	# Active	Hourly Hp-Hrs	Fuel Use (Gal/Hr)	Hours Per Day	Total Work Days	Total Fuel Use
Clamshell Dredging (1)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	24	94	69,034
Dredge - Main Generator	900	0.50	1	450	23.0	24	94	51,775
Dredge - Deck Generator	240	0.60	1	144	7.3	5	94	3,452
Tug Boat	800	0.20	1	160	8.0	4	94	3,008
Disposal at LA-5 (2)								
Tug Boat	2,200	0.60	1	1,320	66.0	6.3	94	39,085

Notes: (1) Based on a daily dredging rate of 3,333 cubic yards (cy), or 4,000 cy with a 1.2 bulk factor. Total dredging volume for the turning basin/quaywall area would be 314,000 cy, or 376,800 cy with a 1.2 bulk factor.

(2) Based on a daily disposal rate of 4,000 cy (bulked), or two barge loads. Total disposal volume of 376,800 cy (bulked). Operations beyond the 3 nm State Waters boundary not included.

Table 3.10-21. Emissions for Dike Construction at Piers J/K - NASNI CVN Homeporting Project.

	Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Dredge Dike Footing with Clamshell						
Dredge - Main Hoist (1)	0.3	2.7	8.2	1.0	0.3	0.3
Dredge - Main Generator (1)	0.2	2.0	6.2	0.7	0.2	0.2
Dredge - Deck Generator (1)	0.1	0.2	0.6	0.0	0.1	0.1
Tug Boat	0.0	0.1	0.4	0.1	0.0	0.0
Disposal at LA-5						
Tug Boat Transport (2)	0.3	0.8	5.7	1.0	0.1	0.1
Rock Placement - Barge Dump						
Tug Boat Transport (2)	0.1	0.3	1.9	0.3	0.0	0.0
Tug Boat - Rock Dumping	0.0	0.0	0.2	0.0	0.0	0.0
Rock Placement - Clamshell						
Tug Boat Transport (2)	0.0	0.1	0.7	0.1	0.0	0.0
Tug Boat - Rock Unloading	0.0	0.0	0.1	0.0	0.0	0.0
Dredge - Main Hoist (1)	0.0	0.1	0.3	0.0	0.0	0.0
Dredge - Main Generator (1)	0.0	0.1	0.2	0.0	0.0	0.0
Dredge - Deck Generator (1)	0.0	0.0	0.0	0.0	0.0	0.0
Dike Filling						
Bulldozer - D6	0.1	0.2	0.5	0.0	0.0	0.0
Sweeper Truck	0.3	6.1	0.2	0.0	0.0	0.0
Vibratory Roller	0.0	0.1	0.3	0.0	0.0	0.0
Water Truck	0.0	0.1	0.3	0.0	0.0	0.0
Total Emissions - Tons	**1.4**	**12.8**	**25.9**	**3.5**	**0.9**	**0.9**
Total Diking Emissions	**0.6**	**7.1**	**4.7**	**0.7**	**0.2**	**0.2**
Total Dredging/Disposal Emissions	**0.8**	**5.7**	**21.2**	**2.8**	**0.8**	**0.7**

Note: (1) NOx emissions reduced by 20% to represent implementation of BACT through the SDCAPCD air permit requirements.

(2) Does not include emissions that would occur beyond the 3-mile State Waters boundary.

Table 3.10-22. Emissions for Construction of the Mitigation Site at Pier B - NASNI CVN Homeporting Project.

	Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Land-based Sediment Removal						
Excavator - Cat 235	0.1	0.5	0.9	0.1	0.1	0.1
Excavator - Cat 235	0.1	0.7	1.4	0.1	0.2	0.2
Bulldozer - D6	0.1	0.3	0.6	0.1	0.1	0.1
Loader - 966	0.0	0.1	0.3	0.0	0.0	0.0
Dump Truck - 15 cu yd loads	0.1	0.4	0.4	0.0	0.0	0.0
Total Emissions - Tons	**0.4**	**1.9**	**3.6**	**0.3**	**0.4**	**0.4**

Table 3.10-23. Emissions for Piers J/K Turning Basin Dredging and Disposal Activities - NASNI CVN Homeporting Project.

	Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Clamshell Dredging - Turning Basin						
Dredge - Main Hoist (1)	0.4	3.8	11.7	1.4	0.5	0.5
Dredge - Main Generator (1)	0.3	2.9	8.8	1.0	0.4	0.3
Dredge - Deck Generator (1)	0.1	0.2	0.8	0.1	0.1	0.1
Tug Boat	0.0	0.1	0.6	0.1	0.0	0.0
Subtotal	**0.8**	**7.0**	**22.0**	**2.6**	**0.9**	**0.9**
Disposal at LA-5 from Turning Basin						
Tug Boat Transport (2)	0.4	1.1	8.2	1.5	0.2	0.2
Total Emissions - Tons	**1.1**	**8.1**	**30.2**	**4.0**	**1.1**	**1.1**

Note: (1) NOx emissions reduced by 20% to represent implementation of BACT through the SDCAPCD air permit requirements.

(2) Does not include emissions that would occur beyond the 3-mile State Waters boundary.

Table 3.10-24. Year 1998 Summer EMFAC7G Composite Emission Factors for NASNI - 5 MPH.

Vehicle Type/ Class	*# of Vehicles Year 1998*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	71,407	0.03	18.73	269.20	4.59
CAT	1,278,014	0.61	1.18	20.49	1.28
Diesel	10,619	0.01	0.93	4.88	2.25
LDT					
NCAT	12,372	0.01	17.31	246.21	4.88
CAT	519,220	0.25	1.59	22.52	2.09
Diesel	5,340	0.00	0.90	4.79	2.11
M/LHDT					
NCAT	8,526	0.00	15.21	225.29	4.82
CAT	96,813	0.05	1.87	16.90	2.43
Diesel	16,643	0.01	1.77	18.89	7.66
MH/HDT					
NCAT	2,726	0.00	18.88	285.06	7.40
CAT	2,050	0.00	3.32	35.51	4.34
Diesel	27,760	0.01	3.84	31.45	15.64
DIESEL BUS	538	0.00	5.64	8.06	33.97
MCY	46,086	0.02	8.67	52.42	0.71
Total	2,098,114	1.00			
Composite Emission Factor			**2.29**	**32.52**	**1.94**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-25. Year 1998 Summer EMFAC7G Composite Emission Factors for NASNI - 25 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2003*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	71,407	0.03	6.90	52.12	1.72
CAT	1,278,014	0.61	0.31	5.16	0.56
Diesel	10,619	0.01	0.40	1.45	1.32
LDT					
NCAT	12,372	0.01	6.40	47.66	1.83
CAT	519,220	0.25	0.42	5.69	0.91
Diesel	5,340	0.00	0.39	1.42	1.24
M/LHDT					
NCAT	8,526	0.00	4.80	49.84	3.75
CAT	96,813	0.05	0.48	4.51	1.91
Diesel	16,643	0.01	0.77	5.61	4.49
MH/HDT					
NCAT	2,726	0.00	4.46	77.69	8.90
CAT	2,050	0.00	0.79	9.68	5.22
Diesel	27,760	0.01	1.67	9.35	9.17
DIESEL BUS	538	0.00	1.93	1.81	15.70
MCY	46,086	0.02	2.23	10.39	0.79
Total	2,098,114	1.00			
Composite Emission Factor			**0.69**	**7.53**	**0.94**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-26. Year 1998 Summer EMFAC7G Composite Emission Factors for NASNI - 55 MPH.

Vehicle Type/ Class	# of Vehicles Year 2003	% of Vehicles In Class	VOC Factor Gms/Mile	CO Factor Gms/Mile	NOx Factor Gms/Mile
LDA					
NCAT	71,407	0.03	5.16	24.54	4.32
CAT	1,278,014	0.61	0.18	4.35	1.01
Diesel	10,619	0.01	0.22	0.92	1.72
LDT					
NCAT	12,372	0.01	4.80	22.45	4.60
CAT	519,220	0.25	0.24	4.66	1.67
Diesel	5,340	0.00	0.21	0.90	1.61
M/LHDT					
NCAT	8,526	0.00	3.23	29.27	5.87
CAT	96,813	0.05	0.26	3.54	2.72
Diesel	16,643	0.01	0.42	3.56	5.85
MH/HDT					
NCAT	2,726	0.00	1.78	57.55	11.15
CAT	2,050	0.00	0.31	7.17	6.54
Diesel	27,760	0.01	0.92	5.92	11.94
DIESEL BUS	538	0.00	1.10	1.17	22.10
MCY	46,086	0.02	1.37	5.65	1.20
Total	2,098,114	1.00			
Composite Emission Factor			**0.45**	**5.37**	**1.62**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-27. Year 1998 Winter EMFAC7G Composite Emission Factors for NASNI - 5 MPH.

Vehicle Type/ Class	# of Vehicles Year 2003	% of Vehicles In Class	VOC Factor Gms/Mile	CO Factor Gms/Mile	NOx Factor Gms/Mile
LDA					
NCAT	71,407	0.03	24.74	387.63	5.31
CAT	1,278,014	0.61	1.25	21.40	1.59
Diesel	10,619	0.01	0.93	4.88	2.25
LDT					
NCAT	12,372	0.01	22.84	354.42	5.65
CAT	519,220	0.25	1.70	23.70	2.59
Diesel	5,340	0.00	0.90	4.79	2.11
M/LHDT					
NCAT	8,526	0.00	19.07	297.72	5.42
CAT	96,813	0.05	2.01	19.06	2.90
Diesel	16,643	0.01	1.77	18.89	7.66
MH/HDT					
NCAT	2,726	0.00	21.26	312.47	7.94
CAT	2,050	0.00	4.00	43.06	5.01
Diesel	27,760	0.01	3.84	31.45	15.64
DIESEL BUS	538	0.00	5.64	8.06	33.97
MCY	46,086	0.02	8.75	52.98	0.82
Total	2,098,114	1.00			
Composite Emission Factor			**2.63**	**38.49**	**2.31**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-28. Year 1998 Winter EMFAC7G Composite Emission Factors for NASNI - 25 MPH.

Vehicle Type/ Class	# of Vehicles Year 2003	% of Vehicles In Class	VOC Factor Gms/Mile	CO Factor Gms/Mile	NOx Factor Gms/Mile
LDA					
NCAT	71,407	0.03	9.11	75.04	1.99
CAT	1,278,014	0.61	0.33	5.39	0.69
Diesel	10,619	0.01	0.40	1.45	1.32
LDT					
NCAT	12,372	0.01	8.44	68.63	2.12
CAT	519,220	0.25	0.45	5.98	1.13
Diesel	5,340	0.00	0.39	1.42	1.24
M/LHDT					
NCAT	8,526	0.00	6.24	64.49	4.14
CAT	96,813	0.05	0.51	5.09	2.24
Diesel	16,643	0.01	0.77	5.61	4.49
MH/HDT					
NCAT	2,726	0.00	5.03	85.16	9.54
CAT	2,050	0.00	0.95	11.74	6.03
Diesel	27,760	0.01	1.67	9.35	9.17
DIESEL BUS	538	0.00	1.93	1.81	15.70
MCY	46,086	0.02	2.26	10.50	0.92
Total	2,098,114	1.00			
Composite Emission Factor			**0.81**	**8.75**	**1.11**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-29. Year 1998 Winter EMFAC7G Composite Emission Factors for NASNI - 55 MPH.

Vehicle Type/ Class	# of Vehicles Year 2003	% of Vehicles In Class	VOC Factor Gms/Mile	CO Factor Gms/Mile	NOx Factor Gms/Mile
LDA					
NCAT	71,407	0.03	6.82	35.34	5.00
CAT	1,278,014	0.61	0.19	4.52	1.25
Diesel	10,619	0.01	0.22	0.92	1.72
LDT					
NCAT	12,372	0.01	6.33	32.32	5.33
CAT	519,220	0.25	0.26	4.89	2.07
Diesel	5,340	0.00	0.21	0.90	1.61
M/LHDT					
NCAT	8,526	0.00	4.17	36.76	6.54
CAT	96,813	0.05	0.27	3.98	3.12
Diesel	16,643	0.01	0.42	3.56	5.85
MH/HDT					
NCAT	2,726	0.00	2.01	63.09	11.96
CAT	2,050	0.00	0.38	8.69	7.55
Diesel	27,760	0.01	0.92	5.92	11.94
DIESEL BUS	538	0.00	1.10	1.17	22.10
MCY	46,086	0.02	1.39	5.71	1.39
Total	2,098,114	1.00			
Composite Emission Factor			**0.53**	**6.02**	**1.92**

VEHICULAR EMISSION CALCULATIONS FOR NASNI

Table 3.10-30. EMFAC7G VOC Composite Emission Factors - NASNI.

	5 MPH			25 MPH			55 MPH			Composite
Year	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
1998	2.63	2.29	0.05	0.81	0.69	0.40	0.53	0.45	0.55	0.69

Table 3.10-31. EMFAC7G CO Composite Emission Factors - NASNI.

	5 MPH			25 MPH			55 MPH			Composite
Year	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
1998	38.49	32.52	0.05	8.75	7.53	0.40	6.02	5.37	0.55	8.17

Table 3.10-32. EMFAC7G NOx Composite Emission Factors - NASNI.

	5 MPH			25 MPH			55 MPH			Composite
Year	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
1998	2.31	1.94	0.05	1.11	0.94	0.40	1.92	1.62	0.55	1.49

Table 3.10-33. ADT Composite Fleet Mix MOBILE 5 VOC Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
1998	6.66	6.46	0.05	1.85	1.76	0.40	1.10	1.05	0.55	1.64

Table 3.10-34. ADT Composite Fleet Mix MOBILE 5 CO Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
1998	70.41	58.04	0.05	19.82	16.27	0.40	10.66	8.79	0.55	15.78

Table 3.10-35. ADT Composite Fleet Mix MOBILE 5 NOx Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
1998	2.00	1.85	0.05	1.70	1.57	0.40	2.24	2.07	0.55	1.94

Table 3.10-36. Composite NASNI Commuter Vehicle VOC Emission Factors.

Year	*California Vehicles*	*Non-California Vehicles*	*Composite Grams/Mile (1)*
1998	0.69	1.64	0.98

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal vehicles.

Table 3.10-37. Composite NASNI Commuter Vehicle CO Emission Factors.

Year	*California Vehicles*	*Non-California Vehicles*	*Composite Grams/Mile (1)*
1998	8.17	15.78	10.45

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal vehicles.

Table 3.10-38. Composite NASNI Commuter Vehicle NOx Emission Factors.

Year	*California Vehicles*	*Non-California Vehicles*	*Composite Grams/Mile (1)*
1998	1.49	1.94	1.62

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal vehicles.

Table 3.10-39. Annual Vehicle Miles Travelled for Vessel Groups Associated with 1998 Existing Conditions at NASNI.

Vessel Group	*Week-day ADT*	*Week-end ADT(1)*	*Annual ADT(2)*	*Miles/ Trip*	*Total Annual Miles*
CVs (3)					
CVs - Berthed	4,579	916	1,215,725	13.0	15,804,419
CV Crew Dependents (4)	10,696	10,696	5,856,060	3.0	17,568,180
CVN (5)					
CVN - Berthed	4,729	946	418,517	13.0	5,440,715
CV Crew Dependents (4)	11,050	11,050	2,016,625	3.0	6,049,875
Onbase Motorpool Mileage	NA	NA	NA	NA	75,000

(1) Week-end ADT for berthed CV/CVN assumed to be 20 percent of week-day estimates.

(2) Maximum annual berthing of 229 days would occur in association with a PIA cycle.

(3) One CV present for one year and one CV present for six months.

(4) CVN crew dependent trips would occur off-base.

(5) One CVN present for six months.

Table 3.10-40. Annual Vehicle Emissions Associated with 1998 Existing Conditions at NASNI.

Vessel Group	*Pounds per Year*		
	VOC	*CO*	*NOx*
CVs	71,902	768,769	119,528
CVN	25,054	267,681	41,426
Total Emissions - Pounds	**96,957**	**1,036,450**	**160,955**
Total Emissions - Tons	**48.48**	**518.23**	**80.48**

Table 3.10-41. Year 2003 Summer EMFAC7G Composite Emission Factors for NASNI - 5 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2003*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	39,619	0.02	19.80	284.88	4.87
CAT	1,400,297	0.62	0.72	14.60	0.87
Diesel	5,544	0.00	1.01	5.37	2.39
LDT					
NCAT	974	0.00	7.98	392.01	4.21
CAT	586,897	0.26	0.81	14.91	1.35
Diesel	2,781	0.00	0.95	5.31	2.23
M/LHDT					
NCAT	4,728	0.00	9.52	245.40	4.89
CAT	128,192	0.06	1.37	17.34	1.89
Diesel	21,948	0.01	0.87	18.64	6.38
MH/HDT					
NCAT	1,071	0.00	16.14	232.60	7.42
CAT	2,869	0.00	4.24	43.88	4.27
Diesel	30,085	0.01	3.09	31.70	12.67
DIESEL BUS	579	0.00	5.61	7.74	30.23
MCY	46,270	0.02	8.66	52.42	0.71
Total	2,271,854	1.00			
Composite Emission Factor			**1.34**	**21.33**	**1.36**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-42. Year 2003 Summer EMFAC7G Composite Emission Factors for NASNI - 25 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2003*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	39,619	0.02	7.29	55.15	1.82
CAT	1,400,297	0.62	0.19	3.69	0.38
Diesel	5,544	0.00	0.44	1.60	1.40
LDT					
NCAT	974	0.00	2.94	75.89	1.58
CAT	586,897	0.26	0.22	3.81	0.59
Diesel	2,781	0.00	0.41	1.58	1.31
M/LHDT					
NCAT	4,728	0.00	2.77	53.94	3.84
CAT	128,192	0.06	0.35	8.85	1.55
Diesel	21,948	0.01	0.38	5.54	3.74
MH/HDT					
NCAT	1,071	0.00	3.82	63.39	8.93
CAT	2,869	0.00	1.00	11.96	5.14
Diesel	30,085	0.01	1.24	9.12	7.43
DIESEL BUS	579	0.00	1.92	1.74	13.97
MCY	46,270	0.02	2.23	10.39	0.79
Total	2,271,854	1.00			
Composite Emission Factor			**0.40**	**5.30**	**0.68**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-43. Year 2003 Summer EMFAC7G Composite Emission Factors for NASNI - 55 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2003*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	39,619	0.02	5.46	25.97	4.58
CAT	1,400,297	0.62	0.12	3.15	0.68
Diesel	5,544	0.00	0.24	1.01	1.82
LDT					
NCAT	974	0.00	2.20	35.74	3.97
CAT	586,897	0.26	0.13	3.21	1.07
Diesel	2,781	0.00	0.23	1.00	1.70
M/LHDT					
NCAT	4,728	0.00	1.63	31.40	5.98
CAT	128,192	0.06	0.18	3.64	2.18
Diesel	21,948	0.01	0.21	3.51	4.87
MH/HDT					
NCAT	1,071	0.00	1.52	46.96	11.19
CAT	2,869	0.00	0.40	8.86	6.44
Diesel	30,085	0.01	0.42	5.78	8.30
DIESEL BUS	579	0.00	0.68	1.12	19.67
MCY	46,270	0.02	1.37	5.65	1.20
Total	2,271,854	1.00			
Composite Emission Factor			**0.26**	**3.77**	**1.12**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-44. Year 2003 Winter EMFAC7G Composite Emission Factors for NASNI - 5 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2003*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	39,619	0.02	26.15	410.21	5.63
CAT	1,400,297	0.62	0.76	15.08	1.08
Diesel	5,544	0.00	1.01	5.37	2.39
LDT					
NCAT	974	0.00	10.55	564.47	4.88
CAT	586,897	0.26	0.83	15.38	1.66
Diesel	2,781	0.00	0.95	5.31	2.23
M/LHDT					
NCAT	4,728	0.00	11.47	325.00	5.49
CAT	128,192	0.06	1.49	14.62	2.25
Diesel	21,948	0.01	0.87	18.64	6.38
MH/HDT					
NCAT	1,071	0.00	18.09	251.47	8.06
CAT	2,869	0.00	5.10	53.21	4.93
Diesel	30,085	0.01	2.85	23.42	12.67
DIESEL BUS	579	0.00	5.61	7.74	30.23
MCY	46,270	0.02	8.75	52.98	0.82
Total	2,271,854	1.00			
Composite Emission Factor			**1.50**	**23.94**	**1.61**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-45. Year 2003 Winter EMFAC7G Composite Emission Factors for NASNI - 25 MPH.

Vehicle Type/ Class	# of Vehicles Year 2003	% of Vehicles In Class	VOC Factor Gms/Mile	CO Factor Gms/Mile	NOx Factor Gms/Mile
LDA					
NCAT	39,619	0.02	9.63	79.41	2.11
CAT	1,400,297	0.62	0.20	3.81	0.47
Diesel	5,544	0.00	0.44	1.60	1.40
LDT					
NCAT	974	0.00	3.88	109.28	1.83
CAT	586,897	0.26	0.22	3.93	0.72
Diesel	2,781	0.00	0.41	1.58	1.31
M/LHDT					
NCAT	4,728	0.00	3.41	69.68	4.24
CAT	128,192	0.06	0.38	5.31	1.82
Diesel	21,948	0.01	0.38	5.54	3.74
MH/HDT					
NCAT	1,071	0.00	4.28	68.53	9.69
CAT	2,869	0.00	1.21	14.50	5.94
Diesel	30,085	0.01	1.53	9.12	7.43
DIESEL BUS	579	0.00	1.92	1.74	13.97
MCY	46,270	0.02	2.26	10.50	0.92
Total	2,271,854	1.00			
Composite Emission Factor			0.45	5.68	0.80

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-46. Year 2003 Winter EMFAC7G Composite Emission Factors for NASNI - 55 MPH.

Vehicle Type/ Class	# of Vehicles Year 2003	% of Vehicles In Class	VOC Factor Gms/Mile	CO Factor Gms/Mile	NOx Factor Gms/Mile
LDA					
NCAT	39,619	0.02	7.21	37.40	5.31
CAT	1,400,297	0.62	0.12	3.24	0.84
Diesel	5,544	0.00	0.24	1.01	1.82
LDT					
NCAT	974	0.00	2.91	51.46	4.60
CAT	586,897	0.26	0.13	3.30	1.32
Diesel	2,781	0.00	0.23	1.00	1.70
M/LHDT					
NCAT	4,728	0.00	2.04	39.49	6.67
CAT	128,192	0.06	0.19	4.11	4.05
Diesel	21,948	0.01	0.21	3.51	4.87
MH/HDT					
NCAT	1,071	0.00	1.71	50.77	12.14
CAT	2,869	0.00	0.48	10.74	7.44
Diesel	30,085	0.01	0.69	5.78	9.67
DIESEL BUS	579	0.00	1.09	1.12	19.67
MCY	46,270	0.02	1.39	5.71	1.39
Total	2,271,854	1.00			
Composite Emission Factor			0.29	4.11	1.43

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-47. Year 2005 Summer EMFAC7G Composite Emission Factors for NASNI - 5 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2005*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	30,444	0.01	19.57	285.89	5.01
CAT	1,441,163	0.62	0.58	12.96	0.75
Diesel	4,336	0.00	1.04	5.56	2.44
LDT					
NCAT	-	-	-	-	-
CAT	611,552	0.26	0.59	12.16	1.14
Diesel	2,130	0.00	0.92	5.60	2.25
M/LHDT					
NCAT	3,634	0.00	9.83	193.76	5.52
CAT	138,646	0.06	1.15	17.30	1.67
Diesel	23,999	0.01	0.66	18.64	5.74
MH/HDT					
NCAT	708	0.00	15.11	208.36	7.39
CAT	3,162	0.00	3.93	45.81	3.84
Diesel	31,309	0.01	2.65	30.56	11.96
DIESEL BUS	595	0.00	5.60	7.68	28.85
MCY	46,344	0.02	8.66	52.42	0.71
Total	2,338,022	1.00			
Composite Emission Factor			**1.17**	**19.33**	**1.20**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-48. Year 2005 Summer EMFAC7G Composite Emission Factors for NASNI - 25 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2005*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	30,444	0.01	7.27	55.35	1.88
CAT	1,441,163	0.62	0.15	3.28	0.32
Diesel	4,336	0.00	0.45	1.65	1.43
LDT					
NCAT	-	-	-	-	-
CAT	611,552	0.26	0.16	3.14	0.50
Diesel	2,130	0.00	0.40	1.66	1.32
M/LHDT					
NCAT	3,634	0.00	2.89	44.03	4.10
CAT	138,646	0.06	0.29	4.63	1.38
Diesel	23,999	0.01	0.29	5.54	3.37
MH/HDT					
NCAT	708	0.00	3.57	56.79	8.89
CAT	3,162	0.00	0.93	12.43	4.62
Diesel	31,309	0.01	1.15	9.08	7.01
DIESEL BUS	595	0.00	1.91	1.73	13.33
MCY	46,344	0.02	2.23	10.39	0.79
Total	2,338,022	1.00			
Composite Emission Factor			**0.35**	**4.59**	**0.61**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-49. Year 2005 Summer EMFAC7G Composite Emission Factors for NASNI - 55 MPH.

Vehicle Type/ Class	# of Vehicles Year 2005	% of Vehicles In Class	VOC Factor Gms/Mile	CO Factor Gms/Mile	NOx Factor Gms/Mile
LDA					
NCAT	30,444	0.01	5.44	26.07	4.72
CAT	1,441,163	0.62	0.09	2.81	0.58
Diesel	4,336	0.00	0.25	1.05	1.86
LDT					
NCAT	-	-	-	-	-
CAT	611,552	0.26	0.10	2.69	0.91
Diesel	2,130	0.00	0.22	1.05	1.72
M/LHDT					
NCAT	3,634	0.00	1.70	26.80	6.59
CAT	138,646	0.06	0.15	3.64	1.93
Diesel	23,999	0.01	0.16	3.51	4.38
MH/HDT					
NCAT	708	0.00	1.43	42.07	11.14
CAT	3,162	0.00	0.37	9.25	5.79
Diesel	31,309	0.01	0.63	5.76	9.13
DIESEL BUS	595	0.00	1.09	1.12	18.77
MCY	46,344	0.02	1.37	5.65	1.20
Total	2,338,022	1.00			
Composite Emission Factor			**0.23**	**3.40**	**1.01**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-50. Year 2005 Winter EMFAC7G Composite Emission Factors for NASNI - 5 MPH.

Vehicle Type/ Class	# of Vehicles Year 2005	% of Vehicles In Class	VOC Factor Gms/Mile	CO Factor Gms/Mile	NOx Factor Gms/Mile
LDA					
NCAT	30,444	0.01	26.08	411.67	5.80
CAT	1,441,163	0.62	0.60	13.34	0.92
Diesel	4,336	0.00	1.04	5.56	2.44
LDT					
NCAT	-	-	-	-	-
CAT	611,552	0.26	0.60	12.34	1.41
Diesel	2,130	0.00	0.92	5.60	2.25
M/LHDT					
NCAT	3,634	0.00	11.89	251.14	6.25
CAT	138,646	0.06	1.26	19.61	1.98
Diesel	23,999	0.01	0.66	18.64	5.74
MH/HDT					
NCAT	708	0.00	17.21	230.36	8.16
CAT	3,162	0.00	4.72	55.55	4.44
Diesel	31,309	0.01	2.65	30.56	11.96
DIESEL BUS	595	0.00	5.60	7.68	28.85
MCY	46,344	0.02	8.75	52.98	0.82
Total	2,338,022	1.00			
Composite Emission Factor			**1.31**	**22.08**	**1.41**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-51. Year 2005 Winter EMFAC7G Composite Emission Factors for NASNI - 25 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2005*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	30,444	0.01	9.61	79.70	2.17
CAT	1,441,163	0.62	0.16	3.37	0.40
Diesel	4,336	0.00	0.45	1.65	1.43
LDT					
NCAT	-	-	-	-	-
CAT	611,552	0.26	0.16	3.18	0.61
Diesel	2,130	0.00	0.40	1.66	1.32
M/LHDT					
NCAT	3,634	0.00	3.55	55.80	4.56
CAT	138,646	0.06	0.31	5.26	1.62
Diesel	23,999	0.01	0.29	5.54	3.37
MH/HDT					
NCAT	708	0.00	4.07	62.78	9.82
CAT	3,162	0.00	1.12	15.14	5.34
Diesel	31,309	0.01	1.15	9.05	7.01
DIESEL BUS	595	0.00	1.91	1.73	13.33
MCY	46,344	0.02	2.26	10.50	0.92
Total	2,338,022	1.00			
Composite Emission Factor			**0.40**	**5.14**	**0.71**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-52. Year 2005 Winter EMFAC7G Composite Emission Factors for NASNI - 55 MPH.

Vehicle Type/ Class	*# of Vehicles Year 2005*	*% of Vehicles In Class*	*VOC Factor Gms/Mile*	*CO Factor Gms/Mile*	*NOx Factor Gms/Mile*
LDA					
NCAT	30,444	0.01	7.19	37.53	5.46
CAT	1,441,163	0.62	0.09	2.88	0.72
Diesel	4,336	0.00	0.25	1.05	1.86
LDT					
NCAT	-	-	-	-	-
CAT	611,552	0.26	0.10	2.72	1.11
Diesel	2,130	0.00	0.22	1.05	1.72
M/LHDT					
NCAT	3,634	0.00	2.13	32.97	7.40
CAT	138,646	0.06	0.15	4.11	2.28
Diesel	23,999	0.01	0.16	3.51	4.38
MH/HDT					
NCAT	708	0.00	1.63	62.78	12.30
CAT	3,162	0.00	0.45	15.14	6.69
Diesel	31,309	0.01	1.13	9.08	9.13
DIESEL BUS	595	0.00	1.09	1.73	18.77
MCY	46,344	0.02	1.39	10.50	1.39
Total	2,338,022	1.00			
Composite Emission Factor			**0.27**	**3.85**	**1.19**

Source: Vehicle fleet data from EMFAC7G Burden output and emission factors from MEI7G (ARB 1997).

Table 3.10-53. EMFAC7G VOC Composite Emission Factors - NASNI.

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
[redacted]										
2003	1.50	1.34	0.05	0.45	0.40	0.40	0.29	0.26	0.55	0.39
2005	1.31	1.17	0.05	0.40	0.35	0.40	0.27	0.23	0.55	0.35

Table 3.10-54. EMFAC7G CO Composite Emission Factors - NASNI.

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
[redacted]										
2003	23.94	21.33	0.05	5.68	5.30	0.40	4.11	3.77	0.55	5.50
2005	22.08	19.33	0.05	5.14	4.59	0.40	3.85	3.40	0.55	4.98

Table 3.10-55. EMFAC7G NOx Composite Emission Factors - NASNI.

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
[redacted]										
2003	1.61	1.36	0.05	0.80	0.68	0.40	1.43	1.12	0.55	1.07
2005	1.41	1.20	0.05	0.71	0.61	0.40	1.19	1.01	0.55	0.93

Table 3.10-56. ADT Composite Fleet Mix MOBILE 5 VOC Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2003	6.33	6.12	0.05	1.86	1.77	0.40	1.09	1.05	0.55	1.63
2005	6.04	5.84	0.05	1.81	1.71	0.40	1.06	1.01	0.55	1.57

Table 3.10-57. ADT Composite Fleet Mix MOBILE 5 CO Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2003	65.08	55.03	0.05	19.46	16.41	0.40	9.48	8.06	0.55	15.00
2005	62.22	52.73	0.05	19.02	16.08	0.40	8.95	7.62	0.55	14.45

Table 3.10-58. ADT Composite Fleet Mix MOBILE 5 NOx Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2003	2.87	2.73	0.05	2.21	2.09	0.40	2.85	2.70	0.55	2.53
2005	2.78	2.64	0.05	2.14	2.03	0.40	2.74	2.60	0.55	2.44

Table 3.10-59. Composite NASNI Commuter Vehicle VOC Emission Factors.

Year	*California Vehicles*	*Non-California Vehicles*	*Composite Grams/Mile (1)*
[illegible]	[illegible]	[illegible]	[illegible]
2003	0.39	1.63	0.76
2005	0.35	1.57	0.72

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal vehicles.

Table 3.10-60. Composite NASNI Commuter Vehicle CO Emission Factors.

Year	*California Vehicles*	*Non-California Vehicles*	*Composite Grams/Mile (1)*
[illegible]	[illegible]	[illegible]	[illegible]
2003	5.50	15.00	8.35
2005	4.98	14.45	7.82

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal vehicles.

Table 3.10-61. Composite NASNI Commuter Vehicle NOx Emission Factors.

Year	*California Vehicles*	*Non-California Vehicles*	*Composite Grams/Mile (1)*
[illegible]	[illegible]	[illegible]	[illegible]
2003	1.07	2.53	1.51
2005	0.93	2.44	1.38

Note: (1) Based on a fleet mix of 70/30 percent Cal/Non-Cal vehicles.

Table 3.10-62. Annual Vehicle Miles Travelled for Vessel Groups Associated with the Operation of the NASNI Alternative Components.

Project Scenario/Year	*Week-day ADT*	*Week-end ADT(1)*	*Annual ADT(2)*	*Miles/ Trip*	*Total Annual Miles*
First Additional CVN/2003					
CVN - Berthed	4,729	946	837,033	13.0	10,881,429
CVN Crew Dependents (3)	11,050	11,050	4,033,250	3.0	12,099,750
Removal of First CV/2003					
CV - Berthed	(4,579)	(916)	(810,483)	13.0	(10,536,279)
CV Crew Dependents (3)	(10,696)	10,696	(3,904,040)	3.0	(11,712,120)
Second Additional CVN/2005 (4)					
CVN - Berthed	4,729	946	50,127	13.0	651,656
CVN Crew Dependents (3)	11,050	11,050	4,033,250	3.0	12,099,750
Onbase Motorpool Mileage (5)	NA	NA	NA	NA	6,500

(1) Week-end ADT for berthed CV/CVN assumed to be 20 percent of week-day estimates.

(2) Maximum annual berthing of 229 days would occur in association with a PIA cycle.

(3) CVN crew dependent trips would occur off-base.

(4) Berthed vehicle trips for a second CVN would occur for 13 days/year in association with annual trips from the first CVN, but dependent trips would be accumulated for an entire year.

(5) Represensts 13 days of operation per year with the presence of a second CVN.

Table 3.10-63. Annual Vehicle Emissions Associated with Operation of Alternatives 1, 2, or 3 at NASNI - Year 2005.

Project Scenario/Year	*Pounds per Year*		
	VOC	*CO*	*NOx*
First Additional CVN - Increment	36,242	396,140	70,103
Removal of First CV - Increment	(35,087)	(383,509)	(67,868)
Second Additional CVN - Increment	20,135	220,076	38,928
Total Emissions - Pounds	**21,291**	**232,707**	**41,163**
Total Emissions - Tons	**10.65**	**116.35**	**20.58**

Table 3.10-64. Annual Vehicle Emissions Associated with Operation of Alternatives 4 or 6 at NASNI - Year 2003.

Project Scenario/Year	*Pounds per Year*		
	VOC	*CO*	*NOx*
First Additional CVN - Increment	38,602	422,898	76,362
Removal of First CV - Increment	(37,371)	(409,414)	(73,927)
Total Emissions - Pounds	**1,231**	**13,485**	**2,435**
Total Emissions - Tons	**0.62**	**6.74**	**1.22**

Table 3.10-65. Annual Vehicle Emissions Associated with the Operation of Alternative 5 at NASNI - Year 2003.

Project Scenario/Year	*Pounds per Year*		
	VOC	*CO*	*NOx*
Removal of First CV - Increment	(37,371)	(409,414)	(73,927)
Total Emissions - Pounds	**(37,371)**	**(409,414)**	**(73,927)**
Total Emissions - Tons	**(18.69)**	**(204.71)**	**(36.96)**

Table 3.10-66. The Net Change in Emissions from the Operation of Alternatives 1, 2, or 3 at NASNI, Year 2005 (+2 CVNs and - 1 CV).

- 1 CV	*Emissions (Pounds per Year)*												
	Vessel Power Plants	**Abr Blasting**	**OWPF**	**NG Boilers**	**Em Gens Onboard**	**Janitorial Supplies**	**Misc. VOC**	**Paints & Solvents**	**Parts Cleaner**	**Propane Equip**	**Fuel Tanks**	**GSE**	**Vehic**
NOx	(122,000)				(6,820)					(4)		(244)	(67,
SOx	(134,000)				(460)					(0)		(16)	
CO	(22,200)				(1,480)					(1)		(53)	(383,
PM	(24,600)	(5)			(500)					(0)		(15)	(
VOC	(4,400)		(127)		(560)	(1,421)	(1,264)	(5,282)		(0)	(4,862)	(23)	(35,

+ 2 CVNs	*Emissions (Pounds per Year)*												
	Vessel Power Plants	**Abr Blasting**	**OWPF**	**NG Boilers**	**Em Gens Onboard**	**Janitorial Supplies**	**Misc. VOC**	**Paints & Solvents**	**Parts Cleaner**	**Propane Equip**	**Fuel Tanks**	**GSE**	**Vehic**
NOx					17,035					4		254	109,
SOx					1,127					0		17	
CO					3,695					1		55	616,
PM		5			1,211					0		16	1,
VOC			132		689	1,483	1,319	5,514		0	5,241	24	56,

Net Change	*Emissions (Pounds per Year)*												
	Vessel Power Plants	**Abr Blasting**	**OWPF**	**NG Boilers**	**Em Gens Onboard**	**Janitorial Supplies**	**Misc. VOC**	**Paints & Solvents**	**Parts Cleaner**	**Propane Equip**	**Fuel Tanks**	**GSE**	**Vehic**
NOx	(122,000)				10,215					0		11	41,
SOx	(134,000)				667					0		1	
CO	(22,200)				2,215					0		2	232,
PM	(24,600)	(0)			711					0		1	
VOC	(4,400)		5		129	62	55	232		0	379	1	21,

Notes: (1) Data for CV power plants and CV/CVN emergency generators obtained from FEIS San Diego Homeporting of One Nimitz Class Aircraft Carrier (DON 1995).

(2) GSE data obtained from Chief Rickabaugh of GSE AIRPAC Everett.

(3) Emissions for all other sources obtained from Table 5.10-2, Volume 5 and factored by populations for each vessel group (EFA Northwest Environmental Technica

Table 3.10-67. The Net Change in Emissions from the Operation of Alternatives 1, 2, or 3 at NASNI, Year 2005 - FSC Equivalent (+2 CVNs and - 2 CVs).

- 1 CV	Emissions (Pounds per Year)													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				(49)										(49)	(0.02)
SOx				0										-	0.00
CO				(10)										(10)	(0.01)
PM				(6)										(6)	(0.00)
VOC				(3)		(474)			(496)		(4,405)			(5,378)	(2.69)
+ 2 CVNs	Emissions (Pounds per Year)													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				98										98	0.05
SOx				1										1	0.00
CO				21										21	0.01
PM				12										12	0.01
VOC				6		947			993		9,099			11,044	5.52
Net Change	Emissions (Pounds per Year)													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				49										49	0.02
SOx				1										1	0.00
CO				11										11	0.01
PM				6										6	0.00
VOC				3		473			497		4,694			5,666	2.83

Table 3.10-68. The Net Change in Emissions from the Operation of Alternatives 4 or 6 at NASNI, Year 2003 (+1 CVN and - 1 CV).

- 1 CV	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx	(122,000)				(6,820)					(4)		(244)	(73,927)	(202,994)	(101.50)	(101.52)
SOx	(134,000)				(460)					(0)		(16)		(134,476)	(67.24)	(67.24)
CO	(22,200)				(1,480)					(1)		(53)	(409,414)	(433,147)	(216.57)	(216.58)
PM	(24,600)	(5)			(500)					(0)		(15)	(981)	(26,101)	(13.05)	(13.05)
VOC	(4,400)		(127)		(560)	(1,421)	(1,264)	(5,282)		(0)	(4,862)	(23)	(37,371)	(55,311)	(27.66)	(30.34)
+ 1 CVNs	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx					16,320					4		244	76,362	92,929	46.46	46.49
SOx					1,080					0		16		1,096	0.55	0.55
CO					3,540					1		53	422,898	426,492	213.25	213.25
PM		5			1,160					0		15	1,013	2,193	1.10	1.10
VOC			127		660	1,421	1,264	5,282		0	5,021	23	38,602	52,400	26.20	28.96
Net Change	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NASNI + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	Ton/Yr
NOx	(122,000)				9,500								2,435	(110,065)	(55)	(55.03)
SOx	(134,000)				620									(133,380)	(67)	(66.69)
CO	(22,200)				2,060								13,485	(6,655)	(3)	(3.33)
PM	(24,600)				660								32	(23,908)	(12)	(11.95)
VOC	(4,400)		(0)		100						159		1,231	(2,910)	(1)	(1.38)

Notes: (1) Data for CV power plants and CV/CVN emergency generators obtained from FEIS San Diego Homeporting of One Nimitz Class Aircraft Carrier (DON 1995).

(2) GSE data obtained from Chief Rickabaugh of GSE AIRPAC Everett.

(3) Emissions for all other sources obtained from Table 5.10-2, Volume 5 and factored by populations for each vessel group (EFA Northwest Environmental Technical Department 1995 and 1997).

Table 3.10-69. The Net Change in Emissions from the Operation of Alternatives 4 or 6 at NASNI, Year 2003 - FSC Equivalent (+1 CVN and - 1 CV).

- 1 CV	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				(49)										(49)	-0.02
SOx				0										-	0.00
CO				(10)										(10)	-0.01
PM				(6)										(6)	0.00
VOC				(3)		(474)			(496)		(4,405)			(5,378)	-2.69
+ 1 CVNs	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				49										49	0.02
SOx				0										0	0.00
CO				10										10	0.01
PM				6										6	0.00
VOC				3		474			496		4,549			5,522	2.76
Net Change	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				-										-	0.00
SOx				0										0	0.00
CO				0										0	0.00
PM				(0)										(0)	(0.00)
VOC				(0)		(0)			0		144			144	0.07

Table 3.10-70. The Net Change in Emissions from the Operation of Alternative 5 at NASNI, Year 2003 (- 1 CV).

- 1 CV	Emissions (Pounds per Year)												
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	
NOx	(122,000)				(6,820)					(4)		(244)	
SOx	(134,000)				(460)					(0)		(16)	
CO	(22,200)				(1,480)					(1)		(53)	
PM	(24,600)	(5)			(500)					(0)		(15)	
VOC	(4,400)		(127)		(560)	(1,421)	(1,264)	(5,282)		(0)	(4,862)	(23)	

Notes: (1) Data for CV power plants and CV/CVN emergency generators obtained from FEIS San Diego Homeporting of One Nimitz Class Aircraft Carrie

(2) GSE data obtained from Chief Rickabaugh of GSE AIRPAC Everett.

(3) Emissions for all other sources obtained from Table 5.10-2, Volume 5 and factored by populations for each vessel group (EFA Northwest Envir

Table 3.10-71. The Net Change in Emissions from the Operation of Alternative 5 at NASNI, Year 2003 (- 1 CV) - FSC Equivalent.

- 1 CV	Emissions (Pounds per Year)												
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		
NOx													
SOx													
CO													
PM													
VOC						(474)			(497)		(4,405)		

NASNI - Year 1998 - Summer Conditions - No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 64. (F) Maximum Temp: 75. (F)
Period 1 RVP: 9.0 Period 2 RVP: 9.0 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
Cal. Year: 1998 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 72.8 / 72.8 / 72.8 F
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.622	0.187	0.085		0.031	0.002	0.001	0.065	0.007	
Composite Emission Factors (Gm/Mile)										
VOC HC:	6.46	8.02	11.36	9.07	16.04	1.38	1.93	4.44	7.37	7.33
Exhst CO:	58.04	72.97	108.80	84.18	186.13	4.41	5.00	30.89	87.68	67.39
Exhst NOX:	1.85	2.11	2.82	2.33	4.59	2.36	2.69	19.10	0.86	3.18

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.622	0.187	0.085		0.031	0.002	0.001	0.065	0.007	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.76	2.11	2.93	2.37	4.54	0.60	0.84	1.93	2.84	2.02
Exhst CO:	16.27	19.87	27.36	22.22	50.73	1.31	1.48	9.17	16.40	18.45
Exhst NOX:	1.57	1.81	2.46	2.02	5.52	1.38	1.58	11.20	0.96	2.44

0Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.622	0.187	0.085		0.031	0.002	0.001	0.065	0.007	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.05	1.35	1.87	1.52	2.65	0.33	0.46	1.06	2.28	1.23
Exhst CO:	8.79	11.80	16.98	13.42	37.58	0.83	0.94	5.81	8.22	10.72
Exhst NOX:	2.07	2.45	3.37	2.74	6.91	1.80	2.06	14.58	1.47	3.21

NASNI - Year 1998 - Winter Conditions - No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 46. (F) Maximum Temp: 65. (F)
Period 1 RVP: 9.0 Period 2 RVP: 9.0 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
Cal. Year: 1998 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 60.2 / 60.2 / 60.2 F
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.622	0.187	0.085		0.031	0.002	0.001	0.065	0.007	
Composite Emission Factors (Gm/Mile)										
VOC HC:	6.66	8.37	11.95	9.49	15.31	1.38	1.93	4.44	7.48	7.55
Exhst CO:	70.41	87.48	127.98	100.16	196.28	4.41	5.00	30.89	98.23	79.81
Exhst NOX:	2.00	2.29	3.05	2.53	4.70	2.36	2.69	19.10	0.91	3.34

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.622	0.187	0.085		0.031	0.002	0.001	0.065	0.007	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.85	2.28	3.18	2.56	4.06	0.60	0.84	1.93	2.56	2.12
Exhst CO:	19.82	24.05	32.47	26.69	53.49	1.31	1.48	9.17	18.37	21.97
Exhst NOX:	1.70	1.97	2.66	2.18	5.65	1.38	1.58	11.20	1.02	2.57

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.622	0.187	0.085		0.031	0.002	0.001	0.065	0.007	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.10	1.46	2.03	1.64	2.14	0.33	0.46	1.06	1.95	1.28
Exhst CO:	10.66	14.13	20.00	15.97	39.63	0.83	0.94	5.81	9.21	12.64
Exhst NOX:	2.24	2.66	3.64	2.97	7.08	1.80	2.06	14.58	1.57	3.39

NASNI - Year 2003 - Summer Conditions - No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 64. (F)   Maximum Temp: 75. (F)
Period 1 RVP: 9.0   Period 2 RVP: 9.0 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
Cal. Year: 2003   Region: Low   Altitude: 500. Ft.
I/M Program: No   Ambient Temp: 72.8 / 72.8 / 72.8 F
Anti-tam. Program: No   Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.606	0.194	0.087		0.031	0.002	0.002	0.072	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.49	6.66	9.34	7.48	11.12	1.07	1.41	4.08	7.32	6.12
Exhst CO:	50.70	58.36	81.81	65.58	101.82	3.86	4.26	29.62	87.68	55.03
Exhst NOX:	1.66	1.97	2.68	2.19	3.94	1.84	2.05	13.54	0.86	2.73

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.606	0.194	0.087		0.031	0.002	0.002	0.072	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.56	1.84	2.54	2.05	3.15	0.46	0.61	1.77	2.83	1.77
Exhst CO:	15.16	17.93	24.58	19.98	27.75	1.15	1.27	8.80	16.40	16.41
Exhst NOX:	1.41	1.63	2.22	1.81	4.74	1.08	1.20	7.94	0.96	2.09

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.606	0.194	0.087		0.031	0.002	0.002	0.072	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	0.90	1.15	1.57	1.28	1.86	0.25	0.34	0.98	2.27	1.05
Exhst CO:	6.74	9.09	12.77	10.22	20.56	0.73	0.80	5.58	8.22	8.06
Exhst NOX:	1.80	2.11	2.90	2.35	5.94	1.41	1.56	10.33	1.47	2.70

NASNI - Year 2003 - Winter Conditions - No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 46. (F)   Maximum Temp: 65. (F)
Period 1 RVP: 9.0   Period 2 RVP: 9.0 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
Cal. Year: 2003   Region: Low   Altitude: 500. Ft.
I/M Program: No   Ambient Temp: 60.2 / 60.2 / 60.2 F
Anti-tam. Program: No   Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.606	0.194	0.087		0.031	0.002	0.002	0.072	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.65	7.02	9.90	7.90	10.64	1.07	1.41	4.08	7.43	6.33
Exhst CO:	60.54	70.89	98.10	79.27	107.46	3.86	4.26	29.62	98.23	65.08
Exhst NOX:	1.79	2.13	2.91	2.37	4.04	1.84	2.05	13.54	0.91	2.87

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.606	0.194	0.087		0.031	0.002	0.002	0.072	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.65	2.00	2.79	2.24	2.80	0.46	0.61	1.77	2.55	1.86
Exhst CO:	18.11	21.86	29.58	24.24	29.29	1.15	1.27	8.80	18.37	19.46
Exhst NOX:	1.52	1.77	2.41	1.97	4.86	1.08	1.20	7.94	1.02	2.21

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.606	0.194	0.087		0.031	0.002	0.002	0.072	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	0.95	1.24	1.72	1.39	1.48	0.25	0.34	0.98	1.94	1.09
Exhst CO:	8.05	11.02	15.28	12.33	21.69	0.73	0.80	5.58	9.21	9.48
Exhst NOX:	1.94	2.29	3.15	2.56	6.08	1.41	1.56	10.33	1.57	2.85

NASNI - Year 2005 - summer Conditions - No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 64. (F) Maximum Temp: 75. (F)
Period 1 RVP: 9.0 Period 2 RVP: 9.0 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
Cal. Year: 2005 Region: Low Altitude: 500. Ft.
I/M Program: No Ambient Temp: 72.8 / 72.8 / 72.8 F
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.25	6.32	8.81	7.08	10.43	0.99	1.34	4.04	7.32	5.84
Exhst CO:	49.42	55.33	76.77	61.91	88.52	3.75	4.13	29.39	87.68	52.73
Exhst NOX:	1.62	1.93	2.64	2.15	3.76	1.76	1.96	12.43	0.86	2.64

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.51	1.77	2.45	1.98	2.94	0.43	0.58	1.75	2.83	1.71
Exhst CO:	15.01	17.60	24.10	19.60	24.12	1.11	1.23	8.73	16.40	16.08
Exhst NOX:	1.38	1.59	2.19	1.77	4.52	1.03	1.15	7.29	0.96	2.03

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	0.87	1.10	1.51	1.23	1.73	0.24	0.32	0.97	2.27	1.01
Exhst CO:	6.42	8.59	12.04	9.65	17.87	0.71	0.78	5.53	8.22	7.62
Exhst NOX:	1.75	2.05	2.82	2.29	5.67	1.35	1.49	9.49	1.47	2.60

1NASNI - Year 2005 - Winter Conditions - No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 46. (F)   Maximum Temp: 65. (F)
Period 1 RVP: 9.0   Period 2 RVP: 9.0 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
Cal. Year: 2005   Region: Low   Altitude: 500. Ft.
I/M Program: No   Ambient Temp: 60.2 / 60.2 / 60.2 F
Anti-tam. Program: No   Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.42	6.67	9.33	7.49	10.02	0.99	1.34	4.04	7.43	6.04
Exhst CO:	58.75	67.24	91.98	74.83	93.81	3.75	4.13	29.39	98.23	62.22
Exhst NOX:	1.75	2.09	2.87	2.33	3.85	1.76	1.96	12.43	0.91	2.78

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.60	1.93	2.69	2.17	2.63	0.43	0.58	1.75	2.55	1.81
Exhst CO:	17.84	21.45	28.97	23.76	25.57	1.11	1.23	8.73	18.37	19.02
Exhst NOX:	1.48	1.73	2.38	1.93	4.63	1.03	1.15	7.29	1.02	2.14

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	0.91	1.20	1.65	1.34	1.39	0.24	0.32	0.97	1.94	1.06
Exhst CO:	7.63	10.42	14.40	11.64	18.94	0.71	0.78	5.53	9.21	8.95
Exhst NOX:	1.89	2.22	3.07	2.48	5.80	1.35	1.49	9.49	1.57	2.74

SCENARIO TITLE: MVEI7G - SD COUNTY 1998 SUMMER

OZONE PLANNING INVENTORY

CALENDAR YEAR: 1998 -- Model Years 1964 to 1998 inclusive

SAN DIEGO Air Basin

EMISSION UNIT: TONS PER DAY

MVEI7G ver 1.0c/DAILY EMISSIONS

SEE COUNTY DETAIL FOR I & M STATUS

ALL ON-ROAD EMISSIONS

	LIGHT DUTY AUTOMOBILES				LIGHT DUTY TRUCKS < 6,000 lbs				MEDIUM DUTY TRUCKS(1) 6,001 to 14,000 lbs				HEAVY DUTY TRUCKS > 14,001 lbs						
	------ GAS ------				------ GAS -----				------ GAS -----				------ GAS-----						
	NON-CAT	CAT	DIESEL	LDA TOTAL	NON-CAT	CAT	DIESEL	LDT TOTAL	NON-CAT	CAT	DIESEL	MDT TOTAL	NON-CAT	CAT	DIESEL	HDT TOTAL	URBAN DIESEL BUSES	MOTOR-CYCLES	ALL VEHICLES
NO. OF IN USE VEHS	71407	1278014	10619	1360040	12372	519220	5340	536932	8526	96813	16643	121982	2726	2050	27760	32536	538	46086	2098114
DAILY VMT (X 1000)	1723	43092	227	45042	173	17714	98	17985	200	3760	531	4491	68	140	2220	2428	83	348	70377
NO. OF DAILY STARTS	320407	7968711	63362	8352480	68825	3234514	31966	3335305	34543	657682	0	692225	11901	24570	0	36471	0	33513	12449994
VOLATILE ORGANIC COMPOUND EMISSIONS																			
RUNNING EXHAUST	12.38	17.05	0.08	29.51	1.31	9.60	0.04	10.94	0.55	2.22	0.36	3.13	0.29	0.11	3.42	3.82	0.17	0.75	48.32
START EXHAUST	2.11	14.29	0.03	16.43	0.54	6.92	0.02	7.48	0.04	1.24	0.00	1.28	0.00	0.00	0.00	0.00	0.00	09	25.39
SUBTOTAL EXHAUST	14.49	31.34	0.11	45.94	1.85	16.52	0.06	18.43	0.59	3.46	0.36	4.42	0.29	0.11	3.42	3.82	0.17	0.93	73.70
DIURNAL EVAPORATION	1.04	2.92	0.00	3.95	0.12	1.18	0.00	1.31	0.05	0.16	0.00	0.21	0.03	0.00	0.00	0.03	0.00	0.04	5.54
HOT SOAK EVAPORATION	1.75	3.62	0.00	5.36	0.27	1.54	0.00	1.81	0.05	0.21	0.00	0.25	0.02	0.01	0.00	0.03	0.00	0.01	7.47
RUNNING LOSSES	3.16	10.58	0.00	13.74	0.06	2.83	0.00	2.89	0.06	0.59	0.00	0.65	0.02	0.02	0.00	0.04	0.00	0.00	17.33
RESTING LOSSES	0.10	2.40	0.00	2.50	0.06	0.95	0.00	1.01	0.00	0.10	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	3.62
SUBTOTAL EVAPORATION	6.05	19.51	0.00	25.56	0.50	6.51	0.00	7.02	0.16	1.06	0.00	1.22	0.07	0.03	0.00	0.10	0.00	0.05	33.95
TOTAL VOC EMISSION	20.54	50.85	0.11	71.50	2.35	23.03	0.06	25.44	0.75	4.52	0.36	5.64	0.35	0.15	3.42	3.92	0.17	0.99	107.65
CARBON MONOXIDE EMISSIONS																			
RUNNING EXHAUST	113.90	314.57	0.34	428.80	9.52	150.36	0.14	160.02	11.58	23.72	2.97	38.27	7.05	1.88	21.35	30.28	0.17	4.15	661.70
START EXHAUST	12.42	148.38	0.36	161.16	3.01	70.94	0.17	74.12	0.25	10.87	0.00	11.13	0.00	0.00	0.00	0.00	0.00	07	247.18
TOTAL CO EMISSION	126.31	462.95	0.70	589.96	12.53	221.29	0.31	234.14	11.83	34.60	2.97	49.40	7.05	1.88	21.35	30.28	0.17	4.92	908.87
OXIDES OF NITROGEN EMISSIONS																			
RUNNING EXHAUST	6.43	40.68	0.41	47.53	0.68	27.45	0.17	28.29	1.56	9.66	3.34	14.55	0.86	1.09	30.23	32.19	1.61	0.40	124.57
START EXHAUST	0.27	11.07	0.01	11.35	0.07	6.87	0.03	6.98	0.01	1.25	0.00	1.26	0.00	0.00	0.00	0.00	0.00	02	19.61
TOTAL NOX EMISSION	6.70	51.75	0.43	58.89	0.75	34.32	0.20	35.27	1.56	10.91	3.34	15.81	0.86	1.09	30.23	32.19	1.61	0.43	144.18
CARBON DIOXIDE EMISSIONS x100																			
RUNNING EXHAUST	6.15	161.12	N/A	167.28	1.06	77.14	N/A	78.20	0.09	15.43	N/A	15.52	N/A	N/A	N/A	N/A	N/A	N/A	261.00
START EXHAUST	0.65	5.69	N/A	6.35	0.15	2.68	N/A	2.83	0.02	0.64	N/A	0.66	N/A	N/A	N/A	N/A	N/A	N/A	9.83
TOTAL CO2 EMISSION	6.81	166.82	N/A	173.62	1.21	79.82	N/A	81.03	0.10	16.08	N/A	16.18	N/A	N/A	N/A	N/A	N/A	N/A	270.83
PARTICULATE MATTER EMISSIONS LESS THAN 10 MICRONS																			
EXHAUST	0.03	0.22	0.08	0.32	0.01	0.10	0.04	0.14	0.01	0.08	0.23	0.32	0.00	0.01	1.84	1.85	0.02	0.02	2.67
TIRE-WEAR	0.01	0.38	0.00	0.39	0.00	0.16	0.00	0.16	0.00	0.04	0.01	0.05	0.00	0.00	0.07	0.07	0.00	0.00	0.67
BRAKE-WEAR	0.01	0.60	0.00	0.61	0.00	0.24	0.00	0.25	0.00	0.05	0.01	0.06	0.00	0.00	0.03	0.03	0.00	0.00	0.96
TOTAL PM10 EMISSION	0.05	1.19	0.08	1.33	0.01	0.50	0.04	0.55	0.02	0.17	0.25	0.43	0.01	0.01	1.94	1.96	0.02	0.02	4.31
LEAD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SULFUR OXIDES- as SO2	0.02	0.45	0.03	0.50	0.00	0.22	0.01	0.23	0.01	0.09	0.31	0.41	0.00	0.01	1.31	1.32	0.05	0.00	2.52
FUEL CONSUMED IN 1000 GALLONS																			
GASOLINE	84.26	1797.77		1882.03	15.03	860.00		875.03	34.64	369.09		403.72	12.01	24.79		36.79		6.97	3204.54
DIESEL			7.54	7.54			3.76	3.76			88.35	88.35			371.80	371.80	14.34		485.80

(1) - MEDIUM DUTY TRUCKS INCLUDES LIGHT HEAVY DUTY TRUCK EMISSIONS

:ENARIO TITLE: MVEI7G - SAN DIEGO COUNTY 2003 SUMMER
ILENDAR YEAR: 2003 -- Model Years 1969 to 2003 inclusive
/EI7G ver 1.0c/DAILY EMISSIONS

PREDICTED CALIFORNIA VEHICLE EMISSIONS
OZONE PLANNING INVENTORY
SAN DIEGO Air Basin

ALL ON-ROAD EMISSIONS

	LIGHT DUTY AUTOMOBILES				LIGHT DUTY TRUCKS < 6,000 lbs				MEDIUM DUTY TRUCKS(1) 6,001 to 14,000 lbs				HEAVY DUTY TRUCKS > 14,001 lbs		
	GAS			LDA	GAS			LDT	GAS			MDT	GAS		
	NON-CAT	CAT	DIESEL	TOTAL	NON-CAT	CAT	DIESEL	TOTAL	NON-CAT	CAT	DIESEL	TOTAL	NON-CAT	CAT	DIE
). OF IN USE VEHS	39619	1400297	5544	1445460	974	586897	2781	590652	4728	128192	21948	154868	1071	2869	3(
ILY VMT (X 1000)	1172	47535	96	48803	14	20100	43	20157	85	4835	650	5570	23	170	2
). OF DAILY STARTS	150031	8699739	31707	8881477	5365	3646971	15998	3668334	14004	849079	0	863083	3453	25982	
VOLATILE ORGANIC COMPOUND EMISSIONS															
JNNING EXHAUST	8.08	10.72	0.04	18.84	0.05	5.01	0.02	5.07	0.22	1.75	0.22	2.19	0.08	0.17	2
TART EXHAUST	0.90	10.28	0.01	11.19	0.03	4.73	0.01	4.78	0.00	1.08	0.00	1.09	0.00	0.00	(
JBTOTAL EXHAUST	8.98	21.00	0.05	30.03	0.08	9.74	0.03	9.85	0.22	2.83	0.22	3.27	0.08	0.17	2
IURNAL EVAPORATION	0.65	2.21	0.00	2.85	0.01	0.80	0.00	0.81	0.01	0.16	0.00	0.17	0.00	0.00	(
OT SOAK EVAPORATION	0.94	2.75	0.00	3.69	0.02	0.97	0.00	0.99	0.01	0.21	0.00	0.23	0.00	0.01	(
UNNING LOSSES	2.93	8.70	0.00	11.63	0.00	2.62	0.00	2.63	0.03	0.58	0.00	0.61	0.01	0.02	(
ESTING LOSSES	0.05	1.51	0.00	1.55	0.00	0.58	0.00	0.58	0.00	0.07	0.00	0.07	0.00	0.00	
UBTOTAL EVAPORATION	4.57	15.16	0.00	19.72	0.04	4.97	0.00	5.01	0.05	1.03	0.00	1.08	0.01	0.03	(
OTAL VOC EMISSION	13.55	36.15	0.05	49.75	0.11	14.72	0.03	14.86	0.27	3.86	0.22	4.35	0.10	0.21	
CARBON MONOXIDE EMISSIONS															
UNNING EXHAUST	82.68	227.66	0.16	310.50	1.23	105.81	0.07	107.12	5.22	29.26	3.61	38.09	1.95	2.87	2
TART EXHAUST	5.14	106.10	0.20	111.45	0.35	50.65	0.09	51.09	0.03	10.91	0.00	10.94	0.00	0.00	
OTAL CO EMISSION	87.82	333.76	0.36	421.95	1.58	156.47	0.17	158.21	5.25	40.18	3.61	49.04	1.95	2.87	2
OXIDES OF NITROGEN EMISSIONS															
UNNING EXHAUST	4.47	27.96	0.18	32.62	0.04	18.52	0.08	18.64	0.69	9.05	3.36	13.09	0.28	1.28	2
TART EXHAUST	0.11	8.92	0.01	9.04	0.00	5.77	0.02	5.79	0.00	1.39	0.00	1.39	0.00	0.00	
OTAL NOX EMISSION	4.58	36.89	0.19	41.66	0.05	24.29	0.09	24.43	0.69	10.44	3.36	14.48	0.28	1.28	2
CARBON DIOXIDE EMISSIONS x100															
UNNING EXHAUST	2.60	172.50	N/A	175.09	0.08	87.56	N/A	87.64	0.01	20.67	N/A	20.68	N/A	N/A	
TART EXHAUST	0.26	6.21	N/A	6.46	0.01	3.03	N/A	3.04	0.00	0.85	N/A	0.85	N/A	N/A	
OTAL CO2 EMISSION	2.85	178.70	N/A	181.56	0.10	90.59	N/A	90.68	0.01	21.52	N/A	21.53	N/A	N/A	
PARTICULATE MATTER EMISSIONS LESS THAN 10 MICRONS															
XHAUST	0.01	0.22	0.03	0.27	0.00	0.10	0.02	0.11	0.00	0.09	0.19	0.29	0.00	0.01	
IRE-WEAR	0.00	0.42	0.00	0.42	0.00	0.18	0.00	0.18	0.00	0.05	0.01	0.06	0.00	0.00	
RAKE-WEAR	0.01	0.66	0.00	0.66	0.00	0.28	0.00	0.28	0.00	0.07	0.01	0.08	0.00	0.00	
OTAL PM10 EMISSION	0.02	1.30	0.04	1.36	0.00	0.55	0.02	0.57	0.01	0.21	0.21	0.43	0.00	0.01	
EAD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
ULFUR OXIDES- as SO2	0.01	0.47	0.01	0.49	0.00	0.24	0.01	0.25	0.00	0.11	0.36	0.48	0.00	0.01	
FUEL CONSUMED IN 1000 GALLONS															
ASOLINE	35.65	1894.25		1929.90	1.25	957.29		958.54	14.99	457.30		472.29	3.97	29.86	
IESEL			3.24	3.24			1.65	1.65			102.21	102.21			38

(1) - MEDIUM DUTY TRUCKS INCLUDES LIGHT HEAVY DUTY TRUCK EMISSIONS

CENARIO TITLE: MVEI7G - SAN DIEGO COUNTY 2005 SUMMER
ALENDAR YEAR: 2005 -- Model Years 1971 to 2005 inclusive
VEI7G ver 1.0c/DAILY EMISSIONS

PREDICTED CALIFORNIA VEHICLE EMISSIONS
OZONE PLANNING INVENTORY
SAN DIEGO Air Basin

RUN DATE: 05/06/99

EMISSION UNIT: TONS PER DAY
SEE COUNTY DETAIL FOR I & M STATUS

ALL ON-ROAD EMISSIONS

	LIGHT DUTY AUTOMOBILES GAS NON-CAT	LIGHT DUTY AUTOMOBILES GAS CAT	LIGHT DUTY AUTOMOBILES DIESEL	LDA TOTAL	LIGHT DUTY TRUCKS < 6,000 lbs GAS NON-CAT	LIGHT DUTY TRUCKS < 6,000 lbs GAS CAT	LIGHT DUTY TRUCKS < 6,000 lbs DIESEL	LDT TOTAL	MEDIUM DUTY TRUCKS(1) 6,001 to 14,000 lbs GAS NON-CAT	MEDIUM DUTY TRUCKS(1) 6,001 to 14,000 lbs GAS CAT	MEDIUM DUTY TRUCKS(1) 6,001 to 14,000 lbs DIESEL	MDT TOTAL	HEAVY DUTY TRUCKS > 14,001 lbs GAS NON-CAT	HEAVY DUTY TRUCKS > 14,001 lbs GAS CAT	HEAVY DUTY TRUCKS > 14,001 lbs DIESEL	HDT TOTAL	URBAN DIESEL BUSES	MOTOR-CYCLES	ALL VEHICLES
O. OF IN USE VEHS	30444	1441163	4336	1475943	0	611552	2130	613682	3634	138646	23999	166279	708	3162	31309	35179	595	46344	2338022
AILY VMT (X 1000)	1020	49586	72	50678	0	21260	33	21293	62	5237	698	5997	13	178	2568	2759	90	396	81213
O. OF DAILY STARTS	106157	9009955	24372	9140484	0	3828505	12141	3840646	10061	917384	0	927445	2085	26732	0	28817	0	37603	1397495
VOLATILE ORGANIC COMPOUND EMISSIONS																			
UNNING EXHAUST	6.77	8.89	0.03	15.69	0.00	3.81	0.01	3.82	0.16	1.52	0.18	1.86	0.05	0.17	2.68	2.90	0.18	0.87	25.32
TART EXHAUST	0.55	8.70	0.01	9.27	0.00	3.95	0.01	3.96	0.00	0.98	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.21	14.41
UBTOTAL EXHAUST	7.33	17.59	0.04	24.96	0.00	7.76	0.02	7.78	0.16	2.50	0.18	2.84	0.05	0.17	2.68	2.90	0.18	1.08	39.73
IURNAL EVAPORATION	0.55	2.01	0.00	2.56	0.00	0.70	0.00	0.70	0.01	0.16	0.00	0.17	0.00	0.00	0.00	0.01	0.00	0.04	3.47
OT SOAK EVAPORATION	0.75	2.49	0.00	3.24	0.00	0.81	0.00	0.81	0.01	0.21	0.00	0.22	0.00	0.01	0.00	0.01	0.00	0.01	4.30
UNNING LOSSES	2.87	7.79	0.00	10.66	0.00	2.43	0.00	2.43	0.02	0.54	0.00	0.56	0.01	0.02	0.00	0.02	0.00	0.00	13.68
ESTING LOSSES	0.03	1.24	0.00	1.27	0.00	0.46	0.00	0.46	0.00	0.06	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	1.80
UBTOTAL EVAPORATION	4.20	13.54	0.00	17.74	0.00	4.39	0.00	4.39	0.04	0.98	0.00	1.01	0.01	0.03	0.00	0.04	0.00	0.05	23.24
OTAL VOC EMISSION	11.53	31.12	0.04	42.69	0.00	12.15	0.02	12.17	0.19	3.47	0.18	3.85	0.06	0.20	2.68	2.94	0.18	1.14	62.97
CARBON MONOXIDE EMISSIONS																			
UNNING EXHAUST	73.11	211.62	0.12	284.85	0.00	89.03	0.06	89.09	3.77	30.04	3.88	37.70	1.09	3.16	23.91	28.15	0.17	4.87	444.82
TART EXHAUST	3.19	93.38	0.16	96.74	0.00	40.21	0.07	40.28	0.01	9.68	0.00	9.69	0.00	0.00	0.00	0.00	0.00	0.87	147.57
OTAL CO EMISSION	76.30	305.00	0.29	381.59	0.00	129.24	0.13	129.37	3.78	39.72	3.88	47.38	1.09	3.16	23.91	28.15	0.17	5.74	592.40
OXIDES OF NITROGEN EMISSIONS																			
UNNING EXHAUST	3.91	25.19	0.14	29.24	0.00	16.82	0.06	16.88	0.50	8.60	3.25	12.35	0.17	1.21	25.78	27.17	1.48	0.45	87.57
TART EXHAUST	0.07	8.42	0.01	8.49	0.00	5.58	0.01	5.59	0.00	1.43	0.00	1.44	0.00	0.00	0.00	0.00	0.00	0.02	15.54
OTAL NOX EMISSION	3.98	33.61	0.15	37.74	0.00	22.40	0.07	22.47	0.50	10.04	3.25	13.79	0.17	1.21	25.78	27.17	1.48	0.47	103.11
CARBON DIOXIDE EMISSIONS x100																			
UNNING EXHAUST	1.61	175.94	N/A	177.56	0.00	92.47	N/A	92.47	0.01	22.66	N/A	22.67	N/A	N/A	N/A	N/A	N/A	N/A	292.69
TART EXHAUST	0.16	6.37	N/A	6.52	0.00	3.18	N/A	3.18	0.00	0.92	N/A	0.92	N/A	N/A	N/A	N/A	N/A	N/A	10.63
OTAL CO2 EMISSION	1.77	182.31	N/A	184.08	0.00	95.65	N/A	95.65	0.01	23.58	N/A	23.59	N/A	N/A	N/A	N/A	N/A	N/A	303.32
PARTICULATE MATTER EMISSIONS LESS THAN 10 MICRONS																			
EXHAUST	0.01	0.23	0.03	0.26	0.00	0.10	0.01	0.11	0.00	0.10	0.19	0.29	0.00	0.01	1.04	1.05	0.01	0.02	1.73
TIRE-WEAR	0.00	0.44	0.00	0.44	0.00	0.19	0.00	0.19	0.00	0.05	0.01	0.06	0.00	0.00	0.08	0.08	0.00	0.00	0.77
BRAKE-WEAR	0.00	0.69	0.00	0.69	0.00	0.29	0.00	0.29	0.00	0.07	0.01	0.08	0.00	0.00	0.04	0.04	0.00	0.01	1.11
OTAL PM10 EMISSION	0.01	1.35	0.03	1.39	0.00	0.58	0.01	0.59	0.00	0.22	0.21	0.43	0.00	0.02	1.15	1.17	0.01	0.03	3.62
LEAD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SULFUR OXIDES- as SO2	0.01	0.48	0.01	0.50	0.00	0.25	0.00	0.26	0.00	0.12	0.38	0.51	0.00	0.01	1.40	1.41	0.05	0.00	2.72
FUEL CONSUMED IN 1000 GALLONS																			
GASOLINE	22.09	1925.01		1947.11	0.00	1003.98		1003.98	10.72	489.06		499.78	2.45	31.41		33.86		7.92	3492.64
DIESEL			2.45	2.45			1.21	1.21			108.28	108.28			396.77	396.77	14.26		522.97

(1) - MEDIUM DUTY TRUCKS INCLUDES LIGHT HEAVY DUTY TRUCK EMISSIONS

TABLE 1: SUMMERTIME RUNNING I/M EXHAUST EMISSION FACTORS AT 75 DEG F

POLLUTANT NAME: VOLATILE ORGANIC COMPOUNDS UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	18.73	1.18	0.93	17.31	1.59	0.90	19.79	2.19	10.62	1.55	1.77	18.88	3.32	3.33	4.35	5.64	8.67
10	14.97	0.56	0.73	13.84	0.75	0.71	15.82	1.07	6.96	1.02	1.39	12.37	2.18	2.62	3.41	4.09	4.57
15	11.75	0.39	0.59	10.87	0.52	0.57	12.41	0.75	4.75	0.69	1.12	8.45	1.49	2.10	2.74	3.07	3.22
16	11.17	0.37	0.56	10.34	0.50	0.54	11.80	0.71	4.43	0.65	1.07	7.87	1.38	2.02	2.63	2.92	3.06
20	9.06	0.33	0.48	8.39	0.45	0.46	9.57	0.63	3.39	0.49	0.92	6.02	1.06	1.72	2.25	2.39	2.61
25	6.90	0.31	0.40	6.40	0.42	0.39	7.29	0.59	2.51	0.37	0.77	4.46	0.79	1.45	1.88	1.93	2.23
30	5.28	0.29	0.35	4.91	0.39	0.33	5.57	0.55	1.94	0.28	0.66	3.45	0.61	1.24	1.62	1.61	1.95
35	4.19	0.26	0.30	3.90	0.35	0.29	4.42	0.49	1.57	0.23	0.58	2.78	0.49	1.09	1.42	1.39	1.72
40	3.63	0.22	0.27	3.39	0.29	0.26	3.84	0.43	1.32	0.19	0.52	2.34	0.41	0.97	1.27	1.24	1.56
45	3.61	0.19	0.25	3.37	0.25	0.24	3.81	0.37	1.15	0.17	0.47	2.05	0.36	0.89	1.16	1.15	1.47
50	4.12	0.17	0.23	3.84	0.22	0.22	4.35	0.34	1.05	0.15	0.44	1.87	0.33	0.83	1.09	1.11	1.42
55	5.16	0.18	0.22	4.80	0.24	0.21	5.46	0.36	1.00	0.15	0.42	1.78	0.31	0.80	1.04	1.10	1.37
60	6.74	0.28	0.22	6.26	0.38	0.21	7.12	0.52	1.00	0.15	0.42	1.77	0.31	0.78	1.02	1.13	1.21
65	8.85	0.76	0.22	8.20	1.09	0.21	9.35	1.23	1.03	0.15	0.42	1.83	0.32	0.78	1.02	1.21	0.83

POLLUTANT NAME: CARBON MONOXIDE UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	269.20	20.49	4.88	246.21	22.52	4.79	292.92	14.59	157.65	19.20	18.89	285.06	35.51	28.33	34.56	8.06	52.42
10	163.93	11.57	3.37	149.93	12.32	3.30	178.38	8.14	104.89	12.77	13.03	189.65	23.63	19.54	23.83	5.07	25.20
15	105.68	7.95	2.43	96.66	8.48	2.38	115.00	5.64	73.73	8.98	9.40	133.31	16.61	14.10	17.20	3.39	16.55
16	97.47	7.50	2.29	89.14	8.02	2.24	106.05	5.34	69.16	8.42	8.85	125.06	15.58	13.28	16.20	3.15	15.56
20	72.13	6.18	1.83	65.97	6.70	1.80	78.49	4.46	54.76	6.67	7.10	99.01	12.33	10.65	12.99	2.40	12.69
25	52.12	5.16	1.45	47.66	5.69	1.42	56.71	3.79	42.96	5.23	5.61	77.69	9.68	8.42	10.27	1.81	10.39
30	39.86	4.48	1.20	36.46	4.98	1.18	43.38	3.32	35.62	4.34	4.64	64.40	8.02	6.96	8.49	1.45	8.72
35	32.28	3.97	1.04	29.52	4.39	1.02	35.12	2.94	31.20	3.80	4.02	56.41	7.03	6.03	7.35	1.23	7.47
40	27.67	3.60	0.94	25.31	3.94	0.92	30.11	2.66	28.87	3.52	3.64	52.21	6.50	5.46	6.66	1.11	6.59
45	25.11	3.44	0.89	22.97	3.69	0.87	27.33	2.51	28.23	3.44	3.45	51.04	6.36	5.18	6.31	1.06	6.08
50	24.13	3.59	0.88	22.07	3.81	0.87	26.26	2.61	29.16	3.55	3.42	52.73	6.57	5.14	6.27	1.08	5.84
55	24.54	4.35	0.92	22.45	4.66	0.90	26.71	3.20	31.83	3.88	3.56	57.55	7.17	5.33	6.51	1.17	5.65
60	26.43	6.62	1.00	24.17	7.51	0.98	28.76	5.11	36.70	4.47	3.86	66.37	8.27	5.80	7.07	1.34	5.07
65	30.13	14.28	1.14	27.55	18.40	1.11	32.78	12.05	44.72	5.45	4.40	80.86	10.07	6.59	8.04	1.63	3.65

POLLUTANT NAME: OXIDES OF NITROGEN UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	4.59	1.28	2.25	4.88	2.09	2.11	4.95	2.66	4.69	2.20	7.66	7.40	4.34	12.84	18.44	33.97	0.71
10	2.41	0.96	1.87	2.56	1.56	1.75	2.60	1.99	4.92	2.31	6.36	7.78	4.56	10.66	15.30	25.99	0.64
15	1.81	0.76	1.61	1.93	1.25	1.51	1.95	1.59	5.16	2.42	5.47	8.15	4.78	9.16	13.15	20.90	0.66
16	1.75	0.73	1.57	1.87	1.20	1.47	1.89	1.52	5.21	2.45	5.33	8.23	4.83	8.92	12.81	20.13	0.66
20	1.66	0.64	1.43	1.76	1.04	1.34	1.79	1.32	5.40	2.53	4.87	8.53	5.00	8.16	11.71	17.67	0.71
25	1.72	0.56	1.32	1.83	0.91	1.24	1.86	1.16	5.64	2.65	4.49	8.90	5.22	7.53	10.81	15.70	0.79
30	1.92	0.53	1.26	2.05	0.86	1.19	2.08	1.09	5.87	2.76	4.30	9.28	5.44	7.20	10.34	14.67	0.87
35	2.23	0.54	1.25	2.38	0.88	1.17	2.41	1.12	6.11	2.87	4.26	9.65	5.66	7.13	10.24	14.41	0.94
40	2.64	0.59	1.28	2.81	0.97	1.21	2.85	1.23	6.35	2.98	4.37	10.03	5.88	7.32	10.51	14.87	0.99
45	3.12	0.69	1.37	3.32	1.14	1.28	3.37	1.44	6.59	3.09	4.65	10.40	6.10	7.79	11.18	16.14	1.02
50	3.68	0.83	1.51	3.92	1.37	1.41	3.98	1.74	6.82	3.20	5.12	10.78	6.32	8.59	12.32	18.42	1.08
55	4.32	1.01	1.72	4.60	1.67	1.61	4.67	2.12	7.06	3.32	5.85	11.15	6.54	9.80	14.07	22.10	1.20
60	5.03	1.24	2.03	5.36	2.04	1.91	5.43	2.60	7.30	3.43	6.92	11.53	6.76	11.60	16.65	27.87	1.48
65	5.81	1.50	2.49	6.18	2.48	2.34	6.27	3.16	7.54	3.54	8.49	11.90	6.98	14.22	20.42	36.95	2.17

POLLUTANT NAME: CARBON DIOXIDE UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	1236.46	945.50	0.00	1170.79	1032.70	0.00	1523.92	1559.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	745.67	608.20	0.00	706.07	695.86	0.00	919.03	1035.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	583.93	435.76	0.00	552.91	506.39	0.00	719.68	738.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	564.09	412.48	0.00	534.13	479.51	0.00	695.23	695.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	506.11	343.23	0.00	479.23	397.06	0.00	623.78	561.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	463.74	293.37	0.00	439.11	334.68	0.00	571.55	453.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	441.09	268.56	0.00	417.66	302.55	0.00	543.63	387.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	431.80	259.92	0.00	408.86	292.66	0.00	532.19	348.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	433.03	262.48	0.00	410.03	302.20	0.00	533.71	328.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	443.50	273.02	0.00	419.95	332.37	0.00	546.61	321.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	462.71	288.69	0.00	438.14	388.42	0.00	570.28	327.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	490.57	306.31	0.00	464.52	357.87	0.00	604.63	518.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	527.27	321.89	0.00	499.26	376.27	0.00	649.85	544.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65	573.11	330.68	0.00	542.67	386.61	0.00	706.35	559.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

POLLUTANT NAME: EXHAUST PARTICULATES, PMEX10 UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.52	0.04
10	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.38	0.04
15	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.28	0.04
16	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.27	0.04
20	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.22	0.04
25	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.18	0.04
30	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.15	0.04
35	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.13	0.04
40	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.11	0.04
45	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.11	0.04
50	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.10	0.04
55	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.10	0.04
60	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.10	0.04
65	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.11	0.04

POLLUTANT NAME: TIRE WEAR PARTICULATES, PMTW10 UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
ALL	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.03	0.00

POLLUTANT NAME: BRAKE WEAR PARTICULATES PMBW10 UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
ALL	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

YEAR: 1998 -- MODEL YEARS 1964 TO 1998 INCLUSIVE -- WINTERTIME
EMFAC7G EMISSION FACTORS

TABLE 1: WINTERTIME RUNNING I/M EXHAUST EMISSION FACTORS AT 50 DEG F

POLLUTANT NAME: VOLATILE ORGANIC COMPOUNDS UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL
5	24.74	1.25	0.93	22.84	1.70	0.90	26.13	2.15	12.00	1.87	1.77	21.26	4.00	3.33	4.35
10	19.78	0.60	0.73	18.27	0.80	0.71	20.89	1.05	7.87	1.22	1.39	13.93	2.62	2.62	3.41
15	15.52	0.41	0.59	14.34	0.56	0.57	16.39	0.73	5.37	0.84	1.12	9.51	1.79	2.10	2.74
16	14.75	0.39	0.56	13.64	0.53	0.54	15.58	0.70	5.00	0.78	1.07	8.86	1.67	2.02	2.63
20	11.96	0.35	0.48	11.07	0.48	0.46	12.64	0.62	3.82	0.59	0.92	6.77	1.27	1.72	2.25
25	9.11	0.33	0.40	8.44	0.45	0.39	9.63	0.57	2.84	0.44	0.77	5.03	0.95	1.45	1.88
30	6.97	0.31	0.35	6.47	0.41	0.33	7.36	0.53	2.20	0.34	0.66	3.89	0.73	1.24	1.62
35	5.53	0.27	0.30	5.14	0.37	0.29	5.84	0.48	1.77	0.28	0.58	3.13	0.59	1.09	1.42
40	4.80	0.23	0.27	4.47	0.31	0.26	5.07	0.42	1.49	0.23	0.52	2.63	0.50	0.97	1.27
45	4.77	0.20	0.25	4.44	0.26	0.24	5.03	0.36	1.30	0.20	0.47	2.31	0.43	0.89	1.16
50	5.44	0.18	0.23	5.06	0.24	0.22	5.75	0.33	1.19	0.19	0.44	2.11	0.40	0.83	1.09
55	6.82	0.19	0.22	6.33	0.26	0.21	7.20	0.35	1.13	0.18	0.42	2.01	0.38	0.80	1.04
60	8.91	0.30	0.22	8.25	0.41	0.21	9.41	0.51	1.12	0.17	0.42	1.99	0.37	0.78	1.02
65	11.70	0.82	0.22	10.82	1.20	0.21	12.35	1.23	1.16	0.18	0.42	2.06	0.39	0.78	1.02

POLLUTANT NAME: CARBON MONOXIDE UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL
5	387.63	21.40	4.88	354.52	23.70	4.79	421.79	14.83	173.64	23.28	18.89	312.47	43.06	28.33	34.56
10	236.05	12.07	3.37	215.89	12.94	3.30	256.85	8.27	115.52	15.49	13.03	207.89	28.65	19.54	23.83
15	152.18	8.29	2.43	139.18	8.91	2.38	165.59	5.73	81.20	10.89	9.40	146.13	20.14	14.10	17.20
16	140.34	7.82	2.29	128.36	8.42	2.24	152.71	5.42	76.18	10.21	8.85	137.09	18.89	13.28	16.20
20	103.86	6.45	1.83	94.99	7.04	1.80	113.01	4.53	60.31	8.09	7.10	108.53	14.96	10.65	12.99
25	75.04	5.39	1.45	68.63	5.98	1.42	81.66	3.84	47.32	6.34	5.61	85.16	11.74	8.42	10.27
30	57.40	4.67	1.20	52.50	5.23	1.18	62.46	3.37	39.23	5.26	4.64	70.60	9.73	6.96	8.49
35	46.48	4.14	1.04	42.51	4.62	1.02	50.58	2.98	34.36	4.61	4.02	61.84	8.52	6.03	7.35
40	39.85	3.76	0.94	36.44	4.13	0.92	43.36	2.69	31.80	4.26	3.64	57.23	7.89	5.46	6.66
45	36.16	3.58	0.89	33.07	3.87	0.87	39.35	2.55	31.09	4.17	3.45	55.95	7.71	5.18	6.31
50	34.75	3.73	0.88	31.78	3.99	0.87	37.81	2.65	32.12	4.31	3.42	57.80	7.97	5.14	6.27
55	35.34	4.52	0.92	32.32	4.89	0.90	38.46	3.25	35.06	4.70	3.56	63.09	8.69	5.33	6.51
60	38.06	6.91	1.00	34.81	7.89	0.98	41.41	5.18	40.43	5.42	3.86	72.75	10.03	5.80	7.07
65	43.38	14.96	1.14	39.68	19.42	1.11	47.21	12.24	49.25	6.60	4.40	88.63	12.22	6.59	8.04

POLLUTANT NAME: OXIDES OF NITROGEN UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL
5	5.31	1.59	2.25	5.65	2.59	2.11	5.74	3.26	5.09	2.54	7.66	7.94	5.01	12.84	18.44
10	2.79	1.19	1.87	2.97	1.93	1.75	3.01	2.44	5.35	2.67	6.36	8.34	5.27	10.66	15.30
15	2.09	0.95	1.61	2.23	1.54	1.51	2.26	1.95	5.60	2.80	5.47	8.74	5.52	9.16	13.15
16	2.03	0.91	1.57	2.16	1.48	1.47	2.19	1.87	5.66	2.82	5.33	8.82	5.57	8.92	12.81
20	1.92	0.79	1.43	2.04	1.29	1.34	2.07	1.62	5.86	2.93	4.87	9.14	5.78	8.16	11.71
25	1.99	0.69	1.32	2.12	1.13	1.24	2.15	1.42	6.12	3.06	4.49	9.54	6.03	7.53	10.81
30	2.22	0.65	1.26	2.37	1.07	1.19	2.40	1.34	6.38	3.18	4.30	9.95	6.28	7.20	10.34
35	2.59	0.67	1.25	2.75	1.09	1.17	2.79	1.37	6.64	3.31	4.26	10.35	6.54	7.13	10.24
40	3.05	0.74	1.28	3.25	1.21	1.21	3.30	1.51	6.89	3.44	4.37	10.75	6.79	7.32	10.51
45	3.61	0.86	1.37	3.85	1.41	1.28	3.91	1.77	7.15	3.57	4.65	11.15	7.05	7.79	11.18
50	4.27	1.03	1.51	4.54	1.70	1.41	4.61	2.13	7.41	3.70	5.12	11.56	7.30	8.59	12.32
55	5.00	1.25	1.72	5.33	2.07	1.61	5.41	2.61	7.67	3.83	5.85	11.96	7.55	9.80	14.07
60	5.82	1.53	2.03	6.20	2.53	1.91	6.29	3.19	7.93	3.96	6.92	12.36	7.81	11.60	16.65
65	6.72	1.86	2.49	7.16	3.08	2.34	7.27	3.88	8.18	4.09	8.49	12.76	8.06	14.22	20.42

POLLUTANT NAME: CARBON DIOXIDE UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	UBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	1780.43	957.88	0.00	1685.86	1046.89	0.00	2194.35	1563.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1073.72	616.12	0.00	1016.69	705.42	0.00	1323.35	1038.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	840.82	441.42	0.00	796.16	513.35	0.00	1036.30	739.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	812.25	417.83	0.00	769.11	486.10	0.00	1001.09	696.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	728.77	347.69	0.00	690.07	402.52	0.00	898.20	562.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	667.76	297.18	0.00	632.29	339.28	0.00	823.00	454.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	635.14	272.06	0.00	601.40	306.71	0.00	782.80	388.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	621.76	263.31	0.00	588.74	296.68	0.00	766.31	349.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	623.54	265.93	0.00	590.42	306.36	0.00	768.50	328.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	638.62	276.61	0.00	604.70	336.93	0.00	787.09	322.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	666.27	292.51	0.00	630.89	393.76	0.00	821.17	328.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	706.40	310.37	0.00	668.88	362.89	0.00	870.62	519.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	759.23	326.17	0.00	718.91	381.55	0.00	935.74	546.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65	825.24	335.08	0.00	781.41	392.04	0.00	1017.10	561.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

POLLUTANT NAME: EXHAUST PARTICULATES, PMEX10 UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.52	0.04
10	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.38	0.04
15	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.28	0.04
16	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.27	0.04
20	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.22	0.04
25	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.18	0.04
30	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.15	0.04
35	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.13	0.04
40	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.11	0.04
45	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.11	0.04
50	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.10	0.04
55	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.10	0.04
60	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.10	0.04
65	0.03	0.00	0.31	0.03	0.00	0.38	0.05	0.00	0.05	0.05	0.40	0.05	0.05	0.57	0.84	0.11	0.04

POLLUTANT NAME: TIRE WEAR PARTICULATES, PMTW10 UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	UBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
ALL	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.03	0.00

POLLUTANT NAME: BRAKE WEAR PARTICULATES PMBW10 UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	UBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
ALL	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

1 Scenario Title: MVEI7G - SAN DIEGO COUNTY 2003 SUMMER REPORT RUN DATE: 12/31/98
YEAR: 2003 -- MODEL YEARS 1969 TO 2003 INCLUSIVE -- SUMMERTIME
EMFAC7G EMISSION FACTORS

TABLE 1: SUMMERTIME RUNNING I/M EXHAUST EMISSION FACTORS AT 75 DEG F

POLLUTANT NAME: VOLATILE ORGANIC COMPOUNDS UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	19.80	0.72	1.01	7.98	0.81	0.95	8.02	1.34	11.02	1.39	0.87	16.14	4.24	2.60	3.09	5.61	8.66
10	15.83	0.35	0.79	6.38	0.39	0.75	6.41	0.66	7.22	0.91	0.68	10.58	2.78	2.04	2.42	4.07	4.57
15	12.42	0.24	0.64	5.01	0.27	0.60	5.03	0.46	4.93	0.62	0.55	7.22	1.90	1.64	1.95	3.06	3.22
16	11.80	0.23	0.61	4.76	0.26	0.58	4.78	0.44	4.59	0.58	0.53	6.73	1.77	1.57	1.87	2.90	3.06
20	9.57	0.21	0.52	3.86	0.23	0.49	3.88	0.39	3.51	0.44	0.45	5.14	1.35	1.34	1.60	2.38	2.61
25	7.29	0.19	0.44	2.94	0.22	0.41	2.95	0.36	2.60	0.33	0.38	3.82	1.00	1.13	1.34	1.92	2.23
30	5.58	0.18	0.37	2.25	0.20	0.35	2.26	0.33	2.01	0.25	0.32	2.95	0.77	0.97	1.15	1.60	1.95
35	4.43	0.16	0.33	1.78	0.18	0.31	1.79	0.30	1.62	0.21	0.28	2.38	0.62	0.85	1.01	1.38	1.72
40	3.84	0.14	0.29	1.55	0.16	0.28	1.55	0.27	1.37	0.17	0.25	2.00	0.53	0.76	0.90	1.24	1.56
45	3.81	0.12	0.27	1.54	0.13	0.25	1.54	0.23	1.20	0.15	0.23	1.75	0.46	0.69	0.83	1.15	1.47
50	4.35	0.11	0.25	1.76	0.12	0.24	1.76	0.21	1.09	0.14	0.22	1.60	0.42	0.65	0.77	1.10	1.42
55	5.46	0.12	0.24	2.20	0.13	0.23	2.21	0.22	1.04	0.13	0.21	1.52	0.40	0.62	0.74	1.09	1.37
60	7.13	0.17	0.24	2.87	0.19	0.22	2.89	0.31	1.03	0.13	0.20	1.51	0.40	0.61	0.72	1.13	1.20
65	9.36	0.44	0.24	3.77	0.49	0.22	3.79	0.69	1.07	0.14	0.20	1.56	0.41	0.61	0.72	1.20	0.83

POLLUTANT NAME: CARBON MONOXIDE UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	284.88	14.60	5.37	392.01	14.91	5.31	327.80	13.61	163.00	21.07	18.64	232.60	43.88	28.20	33.20	7.74	52.42
10	173.48	8.39	3.71	238.72	8.37	3.66	199.62	7.76	108.45	14.02	12.85	154.75	29.19	19.45	22.90	4.87	25.20
15	111.84	5.76	2.67	153.90	5.78	2.64	128.69	5.37	76.23	9.85	9.27	108.78	20.52	14.03	16.52	3.26	16.55
16	103.14	5.43	2.52	141.93	5.46	2.49	118.68	5.07	71.51	9.24	8.74	102.05	19.25	13.22	15.56	3.03	15.56
20	76.33	4.45	2.02	105.04	4.53	2.00	87.83	4.20	56.61	7.32	7.00	80.79	15.24	10.60	12.48	2.31	12.69
25	55.15	3.69	1.60	75.89	3.81	1.58	63.46	3.53	44.42	5.74	5.54	63.39	11.96	8.38	9.86	1.74	10.39
30	42.19	3.19	1.32	58.05	3.32	1.30	48.54	3.08	36.83	4.76	4.58	52.55	9.91	6.93	8.16	1.39	8.72
35	34.16	2.83	1.14	47.01	2.95	1.13	39.31	2.74	32.26	4.17	3.96	46.03	8.68	6.00	7.06	1.18	7.47
40	29.29	2.59	1.04	40.30	2.67	1.02	33.70	2.50	29.85	3.86	3.59	42.60	8.04	5.43	6.40	1.07	6.59
45	26.58	2.50	0.98	36.57	2.54	0.97	30.58	2.39	29.19	3.77	3.40	41.65	7.86	5.15	6.07	1.02	6.08
50	25.54	2.62	0.97	35.14	2.64	0.96	29.38	2.50	30.15	3.90	3.38	43.03	8.12	5.11	6.02	1.04	5.84
55	25.97	3.15	1.01	35.74	3.21	1.00	29.89	3.03	32.91	4.25	3.51	46.96	8.86	5.31	6.25	1.12	5.65
60	27.97	4.65	1.10	38.49	4.98	1.09	32.18	4.64	37.95	4.90	3.81	54.15	10.22	5.77	6.79	1.29	5.07
65	31.88	9.43	1.25	43.87	11.10	1.24	36.69	9.98	46.24	5.98	4.34	65.98	12.45	6.56	7.73	1.57	3.65

POLLUTANT NAME: OXIDES OF NITROGEN UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	4.87	0.87	2.39	4.21	1.35	2.23	4.92	1.90	4.86	1.88	6.38	7.42	4.27	10.87	14.46	30.23	0.71
10	2.55	0.65	1.98	2.21	1.01	1.85	2.58	1.42	5.10	1.98	5.29	7.80	4.49	9.02	12.00	23.13	0.64
15	1.92	0.52	1.70	1.66	0.80	1.59	1.94	1.13	5.35	2.07	4.55	8.18	4.71	7.75	10.31	18.60	0.66
16	1.86	0.50	1.66	1.61	0.77	1.55	1.88	1.09	5.40	2.09	4.43	8.25	4.75	7.55	10.05	17.91	0.66
20	1.76	0.43	1.52	1.52	0.67	1.42	1.78	0.94	5.60	2.17	4.05	8.55	4.92	6.90	9.19	15.72	0.71
25	1.82	0.38	1.40	1.58	0.59	1.31	1.84	0.82	5.84	2.27	3.74	8.93	5.14	6.37	8.48	13.97	0.79
30	2.04	0.36	1.34	1.77	0.55	1.25	2.06	0.78	6.09	2.36	3.58	9.30	5.36	6.09	8.11	13.05	0.87
35	2.37	0.36	1.33	2.05	0.57	1.24	2.40	0.79	6.33	2.46	3.54	9.68	5.57	6.04	8.03	12.82	0.94
40	2.80	0.40	1.36	2.42	0.62	1.27	2.83	0.88	6.58	2.55	3.64	10.06	5.79	6.20	8.25	13.24	0.99
45	3.31	0.47	1.45	2.87	0.73	1.35	3.35	1.02	6.83	2.65	3.87	10.43	6.01	6.59	8.77	14.37	1.02
50	3.91	0.56	1.60	3.38	0.88	1.49	3.95	1.23	7.07	2.74	4.26	10.81	6.22	7.26	9.67	16.39	1.08
55	4.58	0.68	1.82	3.97	1.07	1.70	4.64	1.51	7.32	2.84	4.87	11.19	6.44	8.30	11.04	19.67	1.20
60	5.33	0.83	2.16	4.62	1.31	2.01	5.40	1.84	7.57	2.93	5.76	11.56	6.66	9.82	13.06	24.80	1.48
65	6.16	1.01	2.64	5.33	1.59	2.47	6.23	2.24	7.81	3.03	7.06	11.94	6.87	12.03	16.02	32.88	2.17

1 Scenario Title: MVEI7G - San Diego COUNTY 2003 WINTER REPORT RUN DATE: 12/31/98
YEAR: 2003 -- MODEL YEARS 1969 TO 2003 INCLUSIVE -- WINTERTIME
EMFAC7G EMISSION FACTORS

TABLE 1: WINTERTIME RUNNING I/M EXHAUST EMISSION FACTORS AT 50 DEG F

POLLUTANT NAME: VOLATILE ORGANIC COMPOUNDS UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	UBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	26.15	0.76	1.01	10.55	0.83	0.95	10.56	1.30	12.38	1.68	0.87	18.09	5.10	2.60	3.09	5.61	8.75
10	20.90	0.36	0.79	8.43	0.40	0.75	8.44	0.64	8.11	1.10	0.68	11.85	3.34	2.04	2.42	4.07	4.61
15	16.40	0.25	0.64	6.61	0.28	0.60	6.62	0.44	5.54	0.75	0.55	8.09	2.28	1.64	1.95	3.06	3.25
16	15.59	0.24	0.61	6.29	0.27	0.58	6.29	0.42	5.16	0.70	0.53	7.54	2.12	1.57	1.87	2.90	3.09
20	12.65	0.21	0.52	5.10	0.24	0.49	5.10	0.37	3.95	0.53	0.45	5.76	1.62	1.34	1.60	2.38	2.63
25	9.63	0.20	0.44	3.88	0.22	0.41	3.89	0.35	2.93	0.40	0.38	4.28	1.21	1.13	1.34	1.92	2.26
30	7.37	0.19	0.37	2.97	0.20	0.35	2.97	0.32	2.26	0.31	0.32	3.31	0.93	0.97	1.15	1.60	1.97
35	5.84	0.17	0.33	2.36	0.18	0.31	2.36	0.29	1.83	0.25	0.28	2.67	0.75	0.85	1.01	1.38	1.74
40	5.07	0.14	0.29	2.04	0.16	0.28	2.05	0.26	1.53	0.21	0.25	2.24	0.63	0.76	0.90	1.24	1.57
45	5.04	0.12	0.27	2.03	0.13	0.25	2.03	0.22	1.34	0.18	0.23	1.96	0.55	0.69	0.83	1.15	1.48
50	5.75	0.11	0.25	2.32	0.12	0.24	2.32	0.20	1.23	0.17	0.22	1.79	0.51	0.65	0.77	1.10	1.44
55	7.21	0.12	0.24	2.91	0.13	0.23	2.91	0.21	1.17	0.16	0.21	1.71	0.48	0.62	0.74	1.09	1.39
60	9.41	0.18	0.24	3.80	0.20	0.22	3.80	0.30	1.16	0.16	0.20	1.69	0.48	0.61	0.72	1.13	1.22
65	12.36	0.47	0.24	4.98	0.52	0.22	4.99	0.67	1.20	0.16	0.20	1.75	0.49	0.61	0.72	1.20	0.83

POLLUTANT NAME: CARBON MONOXIDE UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	UBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	410.21	15.08	5.37	564.47	15.38	5.31	472.02	13.70	177.98	25.54	18.64	251.47	53.21	28.20	33.20	7.74	52.98
10	249.80	8.65	3.71	343.74	8.62	3.66	287.44	7.80	118.41	17.00	12.85	167.30	35.40	19.45	22.90	4.87	25.47
15	161.04	5.94	2.67	221.60	5.95	2.64	185.31	5.40	83.23	11.95	9.27	117.60	24.88	14.03	16.52	3.26	16.72
16	148.52	5.60	2.52	204.37	5.62	2.49	170.90	5.10	78.08	11.21	8.74	110.32	23.34	13.22	15.56	3.03	15.72
20	109.91	4.59	2.02	151.24	4.66	2.00	126.47	4.23	61.82	8.87	7.00	87.34	18.48	10.60	12.48	2.31	12.83
25	79.41	3.81	1.60	109.28	3.93	1.58	91.38	3.55	48.50	6.96	5.54	68.53	14.50	8.38	9.86	1.74	10.50
30	60.74	3.29	1.32	83.59	3.42	1.30	69.90	3.10	40.21	5.77	4.58	56.82	12.02	6.93	8.16	1.39	8.82
35	49.19	2.92	1.14	67.69	3.03	1.13	56.60	2.75	35.22	5.06	3.96	49.76	10.53	6.00	7.06	1.18	7.55
40	42.17	2.67	1.04	58.03	2.75	1.02	48.52	2.51	32.60	4.68	3.59	46.05	9.75	5.43	6.40	1.07	6.66
45	38.27	2.57	0.98	52.66	2.61	0.97	44.04	2.40	31.87	4.57	3.40	45.03	9.53	5.15	6.07	1.02	6.14
50	36.77	2.69	0.97	50.60	2.71	0.96	42.31	2.51	32.92	4.73	3.38	46.52	9.84	5.11	6.02	1.04	5.90
55	37.40	3.24	1.01	51.46	3.30	1.00	43.04	3.05	35.93	5.16	3.51	50.77	10.74	5.31	6.25	1.12	5.71
60	40.27	4.80	1.10	55.42	5.13	1.09	46.34	4.67	41.44	5.95	3.81	58.55	12.39	5.77	6.79	1.29	5.13
65	45.91	9.79	1.25	63.17	11.47	1.24	52.83	10.06	50.48	7.25	4.34	71.33	15.09	6.56	7.73	1.57	3.68

POLLUTANT NAME: OXIDES OF NITROGEN UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	5.63	1.08	2.39	4.88	1.66	2.23	5.71	2.32	5.26	2.17	6.38	8.06	4.93	10.87	14.46	30.23	0.82
10	2.96	0.80	1.98	2.56	1.24	1.85	3.00	1.74	5.53	2.29	5.29	8.47	5.18	9.02	12.00	23.13	0.74
15	2.22	0.64	1.70	1.92	0.99	1.59	2.25	1.39	5.80	2.40	4.55	8.87	5.43	7.75	10.31	18.60	0.76
16	2.15	0.62	1.66	1.87	0.95	1.55	2.19	1.33	5.85	2.42	4.43	8.96	5.48	7.55	10.05	17.91	0.77
20	2.03	0.53	1.52	1.76	0.82	1.42	2.06	1.15	6.07	2.51	4.05	9.28	5.69	6.90	9.19	15.72	0.83
25	2.11	0.47	1.40	1.83	0.72	1.31	2.14	1.01	6.33	2.62	3.74	9.69	5.94	6.37	8.48	13.97	0.92
30	2.36	0.44	1.34	2.04	0.68	1.25	2.39	0.95	6.60	2.73	3.58	10.10	6.19	6.09	8.11	13.05	1.01
35	2.74	0.45	1.33	2.37	0.70	1.24	2.78	0.97	6.87	2.84	3.54	10.51	6.44	6.04	8.03	12.82	1.09
40	3.24	0.49	1.36	2.80	0.77	1.27	3.28	1.07	7.13	2.95	3.64	10.92	6.69	6.20	8.25	13.24	1.14
45	3.83	0.57	1.45	3.32	0.90	1.35	3.89	1.25	7.40	3.06	3.87	11.32	6.94	6.59	8.77	14.37	1.19
50	4.52	0.69	1.60	3.92	1.08	1.49	4.59	1.51	7.67	3.17	4.26	11.73	7.19	7.26	9.67	16.39	1.25
55	5.31	0.84	1.82	4.60	1.32	1.70	5.38	1.84	7.93	3.28	4.87	12.14	7.44	8.30	11.04	19.67	1.39
60	6.18	1.03	2.16	5.35	1.61	2.01	6.27	2.26	8.20	3.39	5.76	12.55	7.69	9.82	13.06	24.80	1.72
65	7.13	1.25	2.64	6.18	1.96	2.47	7.24	2.74	8.47	3.50	7.06	12.96	7.94	12.03	16.02	32.88	2.52

1 Scenario Title: MVEI7G - SAN DIEGO COUNTY 2005 SUMMER
YEAR: 2005 -- MODEL YEARS 1971 TO 2005 INCLUSIVE -- SUMMERTIME
EMFAC7G EMISSION FACTORS

REPORT RUN DATE: 12/31/98

TABLE 1: SUMMERTIME RUNNING I/M EXHAUST EMISSION FACTORS AT 75 DEG F

POLLUTANT NAME: VOLATILE ORGANIC COMPOUNDS — UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	19.75	0.58	1.04	0.00	0.59	0.92	8.51	1.03	11.15	1.27	0.66	15.11	3.93	2.47	2.82	5.60	8.66
10	15.78	0.28	0.81	0.00	0.29	0.72	6.80	0.51	7.31	0.83	0.52	9.90	2.57	1.94	2.21	4.06	4.57
15	12.38	0.19	0.65	0.00	0.20	0.58	5.34	0.35	4.99	0.57	0.42	6.76	1.76	1.56	1.77	3.05	3.22
16	11.77	0.18	0.63	0.00	0.19	0.55	5.07	0.34	4.65	0.53	0.40	6.30	1.64	1.49	1.70	2.90	3.06
20	9.55	0.16	0.54	0.00	0.17	0.47	4.11	0.30	3.55	0.40	0.34	4.82	1.25	1.28	1.46	2.38	2.61
25	7.27	0.15	0.45	0.00	0.16	0.40	3.13	0.27	2.64	0.30	0.29	3.57	0.93	1.07	1.22	1.91	2.23
30	5.56	0.14	0.38	0.00	0.15	0.34	2.40	0.26	2.04	0.23	0.25	2.76	0.72	0.92	1.05	1.60	1.95
35	4.41	0.13	0.34	0.00	0.13	0.30	1.90	0.23	1.64	0.19	0.22	2.23	0.58	0.81	0.92	1.38	1.72
40	3.83	0.11	0.30	0.00	0.11	0.27	1.65	0.20	1.38	0.16	0.19	1.87	0.49	0.72	0.82	1.24	1.56
45	3.80	0.10	0.28	0.00	0.10	0.24	1.64	0.18	1.21	0.14	0.18	1.64	0.43	0.66	0.75	1.14	1.47
50	4.34	0.09	0.26	0.00	0.09	0.23	1.87	0.16	1.11	0.13	0.17	1.50	0.39	0.62	0.70	1.10	1.42
55	5.44	0.09	0.25	0.00	0.10	0.22	2.35	0.17	1.05	0.12	0.16	1.43	0.37	0.59	0.67	1.09	1.37
60	7.11	0.13	0.24	0.00	0.14	0.21	3.06	0.24	1.04	0.12	0.16	1.42	0.37	0.58	0.66	1.12	1.20
65	9.33	0.34	0.24	0.00	0.35	0.21	4.02	0.51	1.08	0.12	0.16	1.46	0.38	0.58	0.66	1.20	0.83

POLLUTANT NAME: CARBON MONOXIDE — UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	285.89	12.96	5.56	0.00	12.16	5.60	222.47	13.09	165.05	21.51	18.64	208.36	45.81	28.18	32.93	7.68	52.42
10	174.10	7.50	3.83	0.00	6.93	3.86	135.47	7.51	109.81	14.31	12.85	138.63	30.48	19.43	22.70	4.84	25.20
15	112.24	5.15	2.76	0.00	4.79	2.79	87.34	5.20	77.19	10.06	9.27	97.44	21.43	14.02	16.38	3.23	16.55
16	103.51	4.85	2.60	0.00	4.53	2.63	80.55	4.91	72.41	9.44	8.74	91.41	20.10	13.21	15.43	3.00	15.56
20	76.60	3.96	2.09	0.00	3.74	2.11	59.61	4.06	57.32	7.47	7.00	72.37	15.91	10.59	12.37	2.29	12.69
25	55.35	3.28	1.65	0.00	3.14	1.66	43.07	3.40	44.98	5.86	5.54	56.79	12.49	8.37	9.78	1.73	10.39
30	42.34	2.83	1.37	0.00	2.73	1.38	32.94	2.96	37.29	4.86	4.58	47.08	10.35	6.92	8.09	1.38	8.72
35	34.28	2.51	1.18	0.00	2.42	1.19	26.68	2.63	32.66	4.26	3.96	41.23	9.07	5.99	7.00	1.17	7.47
40	29.39	2.31	1.07	0.00	2.21	1.08	22.87	2.41	30.23	3.94	3.59	38.16	8.39	5.43	6.34	1.06	6.59
45	26.67	2.23	1.02	0.00	2.12	1.02	20.75	2.31	29.55	3.85	3.40	37.31	8.20	5.15	6.02	1.02	6.08
50	25.63	2.34	1.01	0.00	2.22	1.02	19.94	2.43	30.53	3.98	3.38	38.54	8.47	5.11	5.97	1.03	5.84
55	26.07	2.81	1.05	0.00	2.69	1.05	20.28	2.94	33.32	4.34	3.51	42.07	9.25	5.31	6.20	1.12	5.65
60	28.07	4.09	1.14	0.00	4.09	1.15	21.84	4.44	38.43	5.01	3.81	48.51	10.67	5.77	6.74	1.28	5.07
65	32.00	8.07	1.29	0.00	8.65	1.30	24.90	9.25	46.82	6.10	4.34	59.10	13.00	6.56	7.66	1.56	3.65

POLLUTANT NAME: OXIDES OF NITROGEN — UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	5.01	0.75	2.44	0.00	1.14	2.25	6.13	1.64	4.90	1.70	5.74	7.39	3.84	10.44	13.47	28.85	0.71
10	2.63	0.56	2.02	0.00	0.85	1.87	3.22	1.22	5.15	1.79	4.76	7.77	4.04	8.66	11.18	22.07	0.64
15	1.98	0.45	1.74	0.00	0.68	1.61	2.42	0.98	5.40	1.87	4.09	8.14	4.23	7.44	9.61	17.74	0.66
16	1.92	0.43	1.70	0.00	0.65	1.56	2.35	0.94	5.45	1.89	3.99	8.22	4.27	7.25	9.36	17.09	0.66
20	1.81	0.37	1.55	0.00	0.57	1.43	2.21	0.81	5.65	1.96	3.65	8.52	4.43	6.63	8.56	15.00	0.71
25	1.88	0.32	1.43	0.00	0.50	1.32	2.30	0.71	5.90	2.05	3.37	8.89	4.62	6.12	7.90	13.33	0.79
30	2.10	0.30	1.37	0.00	0.47	1.26	2.57	0.67	6.15	2.13	3.22	9.27	4.82	5.85	7.55	12.45	0.87
35	2.44	0.31	1.36	0.00	0.48	1.25	2.99	0.68	6.40	2.22	3.19	9.64	5.01	5.80	7.48	12.23	0.94
40	2.88	0.34	1.39	0.00	0.53	1.28	3.53	0.75	6.64	2.30	3.27	10.02	5.21	5.95	7.68	12.63	0.99
45	3.41	0.40	1.48	0.00	0.62	1.37	4.17	0.88	6.89	2.39	3.48	10.39	5.40	6.33	8.17	13.71	1.02
50	4.02	0.48	1.63	0.00	0.74	1.51	4.93	1.06	7.14	2.48	3.84	10.77	5.60	6.98	9.01	15.64	1.08
55	4.72	0.58	1.86	0.00	0.91	1.72	5.78	1.30	7.39	2.56	4.38	11.14	5.79	7.97	10.28	18.77	1.20
60	5.49	0.71	2.20	0.00	1.11	2.03	6.73	1.59	7.64	2.65	5.18	11.52	5.99	9.43	12.17	23.67	1.48
65	6.34	0.87	2.70	0.00	1.35	2.49	7.77	1.93	7.89	2.73	6.36	11.89	6.18	11.56	14.92	31.38	2.17

1 Scenario Title: MVEI7G - SAN DIEGO COUNTY 2005 WINTER
YEAR: 2005 -- MODEL YEARS 1971 TO 2005 INCLUSIVE -- WINTERTIME
EMFAC7G EMISSION FACTORS

REPORT RUN DATE: 12/31/98

TABLE 1: WINTERTIME RUNNING I/M EXHAUST EMISSION FACTORS AT 50 DEG F

POLLUTANT NAME: VOLATILE ORGANIC COMPOUNDS UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	26.08	0.60	1.04	0.00	0.60	0.92	11.14	0.99	12.61	1.53	0.66	17.21	4.72	2.47	2.82	5.60	8.75
10	20.85	0.29	0.81	0.00	0.29	0.72	8.91	0.49	8.26	1.00	0.52	11.28	3.10	1.94	2.21	4.06	4.61
15	16.36	0.20	0.65	0.00	0.20	0.58	6.99	0.34	5.64	0.68	0.42	7.70	2.11	1.56	1.77	3.05	3.25
16	15.55	0.19	0.63	0.00	0.19	0.55	6.64	0.32	5.26	0.64	0.40	7.17	1.97	1.49	1.70	2.90	3.09
20	12.61	0.17	0.54	0.00	0.17	0.47	5.39	0.29	4.02	0.49	0.34	5.48	1.51	1.28	1.46	2.38	2.63
25	9.61	0.16	0.45	0.00	0.16	0.40	4.11	0.26	2.98	0.36	0.29	4.07	1.12	1.07	1.22	1.91	2.26
30	7.35	0.15	0.38	0.00	0.15	0.34	3.14	0.25	2.31	0.28	0.25	3.15	0.86	0.92	1.05	1.60	1.97
35	5.83	0.13	0.34	0.00	0.13	0.30	2.49	0.22	1.86	0.23	0.22	2.54	0.70	0.81	0.92	1.38	1.74
40	5.05	0.11	0.30	0.00	0.11	0.27	2.16	0.20	1.56	0.19	0.19	2.13	0.59	0.72	0.82	1.24	1.57
45	5.02	0.10	0.28	0.00	0.10	0.24	2.15	0.17	1.37	0.17	0.18	1.87	0.51	0.66	0.75	1.14	1.48
50	5.74	0.09	0.26	0.00	0.09	0.23	2.45	0.15	1.25	0.15	0.17	1.71	0.47	0.62	0.70	1.10	1.44
55	7.19	0.09	0.25	0.00	0.10	0.22	3.07	0.16	1.19	0.14	0.16	1.63	0.45	0.59	0.67	1.09	1.39
60	9.39	0.14	0.24	0.00	0.14	0.21	4.01	0.23	1.18	0.14	0.16	1.61	0.44	0.58	0.66	1.12	1.22
65	12.33	0.37	0.24	0.00	0.36	0.21	5.27	0.50	1.22	0.15	0.16	1.67	0.46	0.58	0.66	1.20	0.83

POLLUTANT NAME: CARBON MONOXIDE UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	411.67	13.34	5.56	0.00	12.34	5.60	320.34	13.13	181.94	26.08	18.64	230.36	55.55	28.18	32.93	7.68	52.98
10	250.69	7.70	3.83	0.00	7.03	3.86	195.07	7.53	121.05	17.35	12.85	153.26	36.96	19.43	22.70	4.84	25.47
15	161.62	5.29	2.76	0.00	4.86	2.79	125.76	5.21	85.09	12.20	9.27	107.73	25.98	14.02	16.38	3.23	16.72
16	149.05	4.98	2.60	0.00	4.59	2.63	115.98	4.92	79.82	11.44	8.74	101.06	24.37	13.21	15.43	3.00	15.72
20	110.30	4.07	2.09	0.00	3.79	2.11	85.83	4.07	63.19	9.06	7.00	80.01	19.30	10.59	12.37	2.29	12.83
25	79.70	3.37	1.65	0.00	3.18	1.66	62.02	3.41	49.58	7.11	5.54	62.78	15.14	8.37	9.78	1.73	10.50
30	60.96	2.91	1.37	0.00	2.76	1.38	47.44	2.96	41.11	5.89	4.58	52.05	12.55	6.92	8.09	1.38	8.82
35	49.36	2.58	1.18	0.00	2.46	1.19	38.41	2.64	36.01	5.16	3.96	45.59	10.99	5.99	7.00	1.17	7.55
40	42.32	2.37	1.07	0.00	2.24	1.08	32.93	2.41	33.32	4.78	3.59	42.19	10.17	5.43	6.34	1.06	6.66
45	38.41	2.29	1.02	0.00	2.15	1.02	29.89	2.32	32.58	4.67	3.40	41.25	9.95	5.15	6.02	1.02	6.14
50	36.90	2.40	1.01	0.00	2.24	1.02	28.71	2.43	33.66	4.82	3.38	42.61	10.28	5.11	5.97	1.03	5.90
55	37.53	2.88	1.05	0.00	2.72	1.05	29.21	2.94	36.73	5.27	3.51	46.51	11.22	5.31	6.20	1.12	5.71
60	40.42	4.21	1.14	0.00	4.15	1.15	31.45	4.45	42.36	6.07	3.81	53.63	12.93	5.77	6.74	1.28	5.13
65	46.07	8.35	1.29	0.00	8.79	1.30	35.85	9.28	51.61	7.40	4.34	65.34	15.76	6.56	7.66	1.56	3.68

POLLUTANT NAME: OXIDES OF NITROGEN UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	5.80	0.92	2.44	0.00	1.41	2.25	7.15	2.00	5.35	1.96	5.74	8.16	4.44	10.44	13.47	28.85	0.82
10	3.04	0.69	2.02	0.00	1.05	1.87	3.75	1.50	5.62	2.06	4.76	8.58	4.66	8.66	11.18	22.07	0.74
15	2.29	0.55	1.74	0.00	0.84	1.61	2.82	1.19	5.89	2.16	4.09	8.99	4.89	7.44	9.61	17.74	0.76
16	2.22	0.53	1.70	0.00	0.80	1.56	2.73	1.15	5.94	2.18	3.99	9.08	4.93	7.25	9.36	17.09	0.77
20	2.09	0.46	1.55	0.00	0.70	1.43	2.58	0.99	6.16	2.26	3.65	9.41	5.11	6.63	8.56	15.00	0.83
25	2.17	0.40	1.43	0.00	0.61	1.32	2.68	0.87	6.43	2.36	3.37	9.82	5.34	6.12	7.90	13.33	0.92
30	2.43	0.38	1.37	0.00	0.57	1.26	2.99	0.82	6.70	2.46	3.22	10.23	5.56	5.85	7.55	12.45	1.01
35	2.82	0.38	1.36	0.00	0.59	1.25	3.48	0.84	6.97	2.56	3.19	10.65	5.79	5.80	7.48	12.23	1.09
40	3.33	0.42	1.39	0.00	0.65	1.28	4.11	0.92	7.24	2.66	3.27	11.06	6.01	5.95	7.68	12.63	1.14
45	3.95	0.49	1.48	0.00	0.76	1.37	4.86	1.08	7.52	2.76	3.48	11.48	6.24	6.33	8.17	13.71	1.19
50	4.66	0.59	1.63	0.00	0.91	1.51	5.74	1.30	7.79	2.86	3.84	11.89	6.46	6.98	9.01	15.64	1.25
55	5.46	0.72	1.86	0.00	1.11	1.72	6.73	1.59	8.06	2.96	4.38	12.30	6.69	7.97	10.28	18.77	1.39
60	6.36	0.88	2.20	0.00	1.36	2.03	7.84	1.94	8.33	3.06	5.18	12.72	6.91	9.43	12.17	23.67	1.72
65	7.34	1.07	2.70	0.00	1.66	2.49	9.05	2.36	8.60	3.16	6.36	13.13	7.14	11.56	14.92	31.38	2.52

POLLUTANT NAME: CARBON DIOXIDE UNITS: GRAMS PER MILE

SPEED	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MD. DUTY TRUCKS		LIGHT HEAVY TRUCKS			MEDIUM HEAVY TRUCKS			HH TRK	URBAN BUS	MCY
MPH	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	DIESEL	DIESEL	ALL
5	1779.73	898.36	0.00	0.00	1032.29	0.00	2194.35	1557.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1073.30	578.87	0.00	0.00	695.58	0.00	1323.35	1034.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

BREMERTON (2000) Typical Summer Day - Ozone, No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 60. (F)   Maximum Temp: 92. (F)
Period 1 RVP: 8.7   Period 2 RVP: 8.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of July 1st of the indicated calendar year.
User supplied veh registration distributions.
Cal. Year: 2000   Region: Low   Altitude: 500. Ft.
I/M Program: No   Ambient Temp: 83.8 / 83.8 / 83.8 F
Anti-tam. Program: No   Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.636	0.183	0.088		0.028	0.002	0.001	0.058	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	7.31	9.79	12.41	10.64	20.94	1.28	1.83	4.60	13.80	8.45
Exhst CO:	54.30	78.44	104.75	86.96	195.70	4.23	4.84	32.87	109.78	65.98
Exhst NOX:	1.71	2.33	2.79	2.48	4.62	2.17	2.54	20.90	0.79	3.11

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.636	0.183	0.088		0.028	0.002	0.001	0.058	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.97	2.73	3.30	2.92	6.84	0.55	0.79	1.99	7.66	2.39
Exhst CO:	15.48	22.41	27.81	24.16	53.33	1.26	1.44	9.76	20.53	18.54
Exhst NOX:	1.44	1.97	2.39	2.11	5.55	1.27	1.49	12.25	0.88	2.36

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.636	0.183	0.088		0.028	0.002	0.001	0.058	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.18	1.79	2.12	1.90	4.69	0.31	0.44	1.10	6.89	1.49
Exhst CO:	7.58	12.80	16.18	13.89	39.51	0.80	0.91	6.19	10.29	10.10
Exhst NOX:	1.88	2.63	3.21	2.82	6.96	1.66	1.94	15.96	1.36	3.09

BREMERTON (2000) Typical Winter Day, No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 34. (F)   Maximum Temp: 50. (F)
Period 1 RVP: 13.7   Period 2 RVP: 13.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
User supplied veh registration distributions.
Cal. Year: 2000   Region: Low   Altitude: 500. Ft.
I/M Program: No   Ambient Temp: 45.9 / 45.9 / 45.9 F
Anti-tam. Program: No   Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	7.98	11.17	14.21	12.16	17.55	1.31	1.90	4.68	11.62	9.18
Exhst CO:	82.47	117.87	151.77	128.86	203.25	4.27	4.94	33.12	128.26	95.52
Exhst NOX:	2.07	2.83	3.39	3.01	4.99	2.21	2.63	21.56	0.98	3.52

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	2.23	3.21	3.94	3.45	4.67	0.57	0.82	2.03	4.02	2.62
Exhst CO:	23.72	33.93	40.79	36.15	55.39	1.27	1.47	9.84	23.98	27.10
Exhst NOX:	1.76	2.41	2.91	2.57	6.01	1.29	1.54	12.64	1.09	2.72

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.32	2.05	2.51	2.20	2.51	0.31	0.46	1.12	3.07	1.58
Exhst CO:	11.73	19.25	23.60	20.66	41.04	0.80	0.93	6.23	12.02	14.62
Exhst NOX:	2.29	3.22	3.93	3.45	7.53	1.69	2.00	16.46	1.68	3.56

EVERETT YEAR 2000 SUMMERTIME OZONE 1993 I/M PROGRAM
MOBILE5a (26-Mar-93)
I/M program selected:

Start year (January 1):	1993
Pre-1981 MYR stringency rate:	28%
First model year covered:	1968
Last model year covered:	1997
Waiver rate (pre-1981):	15.%
Waiver rate (1981 and newer):	14.%
Compliance Rate:	90.%
Inspection type:	Test Only
Inspection frequency	Biennial
Vehicle types covered:	LDGV - Yes
	LDGT1 - Yes
	LDGT2 - Yes
	HDGV - Yes
1981 & later MYR test type:	2500 rpm / Idle

Cutpoints, HC: 220.000 CO: 1.200 NOx: 999.000
Minimum Temp: 60. (F) Maximum Temp: 92. (F)
Period 1 RVP: 8.7 Period 2 RVP: 8.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
User supplied veh registration distributions.
Cal. Year: 2000 Region: Low Altitude: 500. Ft.
I/M Program: Yes Ambient Temp: 83.8 / 83.8 / 83.8 F
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
0Composite Emission Factors (Gm/Mile)										
VOC HC:	6.81	9.07	11.55	9.87	21.29	1.31	1.90	4.68	13.80	7.94
Exhst CO:	44.88	66.61	88.04	73.56	195.30	4.27	4.94	33.12	109.78	56.36
Exhst NOX:	1.70	2.30	2.76	2.45	4.64	2.21	2.63	21.56	0.79	3.13

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.82	2.51	3.04	2.68	7.01	0.57	0.82	2.03	7.66	2.23
Exhst CO:	12.79	18.85	23.04	20.21	53.22	1.27	1.47	9.84	20.53	15.76
Exhst NOX:	1.45	1.96	2.37	2.09	5.58	1.29	1.54	12.64	0.88	2.38

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.09	1.66	1.96	1.76	4.84	0.31	0.46	1.12	6.89	1.40
Exhst CO:	6.29	10.86	13.52	11.72	39.43	0.80	0.93	6.23	10.29	8.69
Exhst NOX:	1.88	2.63	3.20	2.81	6.99	1.69	2.00	16.46	1.36	3.11

EVERETT YEAR 2000 WINTERTIME CO 1993 I/M PROGRAM
MOBILE5a (26-Mar-93)

I/M program selected:

Start year (January 1):	1993
Pre-1981 MYR stringency rate:	28%
First model year covered:	1968
Last model year covered:	1997
Waiver rate (pre-1981):	15.%
Waiver rate (1981 and newer):	14.%
Compliance Rate:	90.%
Inspection type:	Test Only
Inspection frequency	Biennial
Vehicle types covered:	LDGV - Yes
	LDGT1 - Yes
	LDGT2 - Yes
	HDGV - Yes
1981 & later MYR test type:	2500 rpm / Idle

Cutpoints, HC: 220.000 CO: 1.200 NOx: 999.000
Minimum Temp: 34. (F) Maximum Temp: 50. (F)
Period 1 RVP: 13.7 Period 2 RVP: 13.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
User supplied veh registration distributions.
Cal. Year: 2000 Region: Low Altitude: 500. Ft.
I/M Program: Yes Ambient Temp: 45.9 / 45.9 / 45.9 F
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	7.00	9.81	12.55	10.69	16.99	1.31	1.90	4.68	11.62	8.15
Exhst CO:	68.94	99.59	126.27	108.24	188.69	4.27	4.94	33.12	128.26	80.94
Exhst NOX:	2.05	2.79	3.35	2.97	4.97	2.21	2.63	21.56	0.98	3.50

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.95	2.81	3.46	3.02	4.54	0.57	0.82	2.03	4.02	2.32
Exhst CO:	19.87	28.78	34.12	30.51	51.42	1.27	1.47	9.84	23.98	23.02
Exhst NOX:	1.74	2.37	2.88	2.54	5.97	1.29	1.54	12.64	1.09	2.70

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.637	0.182	0.087		0.028	0.002	0.001	0.057	0.005	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.15	1.80	2.20	1.93	2.46	0.31	0.46	1.12	3.07	1.40
Exhst CO:	9.70	16.20	19.63	17.32	38.10	0.80	0.93	6.23	12.02	12.34
Exhst NOX:	2.27	3.18	3.88	3.40	7.48	1.69	2.00	16.46	1.68	3.53

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EVERETT YEAR 2005 SUMMERTIME OZONE 1993 I/M PROGRAM
MOBILE5a (26-Mar-93)
I/M program selected:
    Start year (January 1):              1993
     Pre-1981 MYR stringency rate:         28%
     First model year covered:            1968
     Last model year covered:             2002
     Waiver rate (pre-1981):              15.%
     Waiver rate (1981 and newer):        14.%
     Compliance Rate:                     90.%
     Inspection type:                     Test Only
     Inspection frequency                 Biennial
     Vehicle types covered:               LDGV - Yes
                                         LDGT1 - Yes
                                         LDGT2 - Yes
                                          HDGV - Yes
     1981 & later MYR test type:          2500 rpm / Idle
     Cutpoints, HC:  220.000   CO:    1.200   NOx:  999.000
Minimum Temp: 60. (F)   Maximum Temp: 92. (F)
Period 1 RVP:  8.7      Period 2 RVP:  8.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.
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Emission factors are as of Jan. 1st of the indicated calendar year.
User supplied veh registration distributions.
Cal. Year: 2005            Region: Low          Altitude:  500. Ft.
I/M Program: Yes        Ambient Temp:   83.8 / 83.8 / 83.8 F
Anti-tam. Program: No      Operating Mode:   20.6 / 27.3 / 20.6
Reformulated Gas: No
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Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.622	0.189	0.089		0.028	0.002	0.002	0.064	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.74	7.71	9.47	8.27	15.58	1.03	1.43	4.12	13.80	6.64
Exhst CO:	39.74	52.62	65.18	56.64	99.84	3.82	4.25	31.22	109.78	45.77
Exhst NOX:	1.62	2.24	2.76	2.40	4.10	1.83	2.04	15.41	0.79	2.79

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.622	0.189	0.089		0.028	0.002	0.002	0.064	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.59	2.17	2.57	2.30	5.01	0.45	0.62	1.78	7.66	1.92
Exhst CO:	12.03	16.56	20.17	17.71	27.21	1.14	1.26	9.27	20.53	13.86
Exhst NOX:	1.38	1.85	2.29	1.99	4.93	1.07	1.20	9.04	0.88	2.13

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.622	0.189	0.089		0.028	0.002	0.002	0.064	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	0.94	1.40	1.62	1.47	3.43	0.25	0.34	0.99	6.89	1.18
Exhst CO:	5.18	8.27	10.38	8.94	20.16	0.72	0.80	5.88	10.29	6.70
Exhst NOX:	1.75	2.40	2.97	2.58	6.17	1.40	1.56	11.77	1.36	2.74

EVERETT YEAR 2005 WINTERTIME CO 1993 I/M PROGRAM
MOBILE5a (26-Mar-93)
I/M program selected:

Start year (January 1):	1993
Pre-1981 MYR stringency rate:	28%
First model year covered:	1968
Last model year covered:	2002
Waiver rate (pre-1981):	15.%
Waiver rate (1981 and newer):	14.%
Compliance Rate:	90.%
Inspection type:	Test Only
Inspection frequency	Biennial
Vehicle types covered:	LDGV - Yes
	LDGT1 - Yes
	LDGT2 - Yes
	HDGV - Yes
1981 & later MYR test type:	2500 rpm / Idle

Cutpoints, HC: 220.000 CO: 1.200 NOx: 999.000
Minimum Temp: 34. (F) Maximum Temp: 50. (F)
Period 1 RVP: 13.7 Period 2 RVP: 13.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
User supplied veh registration distributions.
Cal. Year: 2005 Region: Low Altitude: 500. Ft.
I/M Program: Yes Ambient Temp: 45.9 / 45.9 / 45.9 F
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.622	0.189	0.089		0.028	0.002	0.002	0.064	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	6.06	8.56	10.57	9.21	12.97	1.03	1.43	4.12	11.62	7.01
Exhst CO:	61.10	83.56	101.11	89.18	104.91	3.82	4.25	31.22	128.26	68.32
Exhst NOX:	1.93	2.70	3.33	2.90	4.27	1.83	2.04	15.41	0.98	3.12

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.622	0.189	0.089		0.028	0.002	0.002	0.064	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.77	2.52	3.07	2.70	3.44	0.45	0.62	1.78	4.02	2.08
Exhst CO:	18.50	26.49	31.57	28.12	28.59	1.14	1.26	9.27	23.98	20.83
Exhst NOX:	1.64	2.24	2.76	2.40	5.13	1.07	1.20	9.04	1.09	2.42

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.622	0.189	0.089		0.028	0.002	0.002	0.064	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.03	1.58	1.91	1.68	1.87	0.25	0.34	0.99	3.07	1.24
Exhst CO:	7.97	13.08	16.02	14.02	21.18	0.72	0.80	5.88	12.02	9.88
Exhst NOX:	2.09	2.89	3.58	3.11	6.43	1.40	1.56	11.77	1.68	3.11

EVERETT YEAR 2007 SUMMERTIME OZONE 1993 I/M PROGRAM
MOBILE5a (26-Mar-93)
I/M program selected:

Start year (January 1):	1993
Pre-1981 MYR stringency rate:	28%
First model year covered:	1968
Last model year covered:	2004
Waiver rate (pre-1981):	15.%
Waiver rate (1981 and newer):	14.%
Compliance Rate:	90.%
Inspection type:	Test Only
Inspection frequency	Biennial
Vehicle types covered:	LDGV - Yes
	LDGT1 - Yes
	LDGT2 - Yes
	HDGV - Yes
1981 & later MYR test type:	2500 rpm / Idle

Cutpoints, HC: 220.000 CO: 1.200 NOx: 999.000
Minimum Temp: 60. (F) Maximum Temp: 92. (F)
Period 1 RVP: 8.7 Period 2 RVP: 8.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
User supplied veh registration distributions.
Cal. Year: 2007 Region: Low Altitude: 500. Ft.
I/M Program: Yes Ambient Temp: 83.8 / 83.8 / 83.8 F
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.618	0.191	0.089		0.029	0.002	0.002	0.066	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.50	7.50	9.25	8.06	14.73	0.97	1.38	4.05	13.80	6.40
Exhst CO:	39.24	50.94	62.95	54.77	87.01	3.71	4.19	30.82	109.78	44.56
Exhst NOX:	1.60	2.19	2.75	2.37	3.96	1.71	1.97	13.52	0.79	2.66

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.618	0.191	0.089		0.029	0.002	0.002	0.066	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.53	2.12	2.53	2.25	4.68	0.42	0.60	1.76	7.66	1.86
Exhst CO:	11.93	16.39	20.02	17.55	23.71	1.10	1.25	9.15	20.53	13.66
Exhst NOX:	1.35	1.81	2.27	1.96	4.76	1.00	1.15	7.93	0.88	2.05

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.618	0.191	0.089		0.029	0.002	0.002	0.066	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	0.91	1.36	1.58	1.43	3.19	0.23	0.33	0.97	6.89	1.14
Exhst CO:	5.02	7.87	9.84	8.50	17.57	0.70	0.79	5.80	10.29	6.41
Exhst NOX:	1.72	2.33	2.93	2.52	5.96	1.30	1.50	10.32	1.36	2.63

EVERETT YEAR 2007 WINTERTIME CO 1993 I/M PROGRAM
MOBILE5a (26-Mar-93)

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Start year (January 1):                1993
     Pre-1981 MYR stringency rate:       28%
     First model year covered:          1968
     Last model year covered:           2004
     Waiver rate (pre-1981):            15.%
     Waiver rate (1981 and newer):      14.%
     Compliance Rate:                   90.%
     Inspection type:                   Test Only
     Inspection frequency               Biennial
     Vehicle types covered:             LDGV - Yes
                                       LDGT1 - Yes
                                       LDGT2 - Yes
                                        HDGV - Yes
     1981 & later MYR test type:        2500 rpm / Idle
     Cutpoints, HC:  220.000   CO:    1.200   NOx:  999.000
Minimum Temp: 34. (F)   Maximum Temp: 50. (F)
Period 1 RVP: 13.7      Period 2 RVP: 13.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.
```

Emission factors are as of Jan. 1st of the indicated calendar year.
User supplied veh registration distributions.

```
Cal. Year: 2007          Region: Low         Altitude:  500. Ft.
I/M Program: Yes       Ambient Temp:   45.9 / 45.9 / 45.9 F
Anti-tam. Program: No     Operating Mode:   20.6 / 27.3 / 20.6
Reformulated Gas: No
```

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.618	0.191	0.089		0.029	0.002	0.002	0.066	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.89	8.41	10.41	9.05	12.52	0.97	1.38	4.05	11.62	6.85
Exhst CO:	59.79	81.28	98.33	86.72	94.04	3.71	4.19	30.82	128.26	66.49
Exhst NOX:	1.90	2.64	3.31	2.86	4.10	1.71	1.97	13.52	0.98	2.99

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.618	0.191	0.089		0.029	0.002	0.002	0.066	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.74	2.48	3.04	2.66	3.31	0.42	0.60	1.76	4.02	2.05
Exhst CO:	18.19	26.26	31.45	27.91	25.63	1.10	1.25	9.15	23.98	20.49
Exhst NOX:	1.61	2.18	2.74	2.36	4.93	1.00	1.15	7.93	1.09	2.32

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.618	0.191	0.089		0.029	0.002	0.002	0.066	0.004	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.00	1.54	1.87	1.64	1.79	0.23	0.33	0.97	3.07	1.21
Exhst CO:	7.65	12.52	15.31	13.41	18.99	0.70	0.79	5.80	12.02	9.46
Exhst NOX:	2.04	2.80	3.53	3.03	6.18	1.30	1.50	10.32	1.68	2.98

Pearl Harbor (2005) Summertime, No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 73. (F)   Maximum Temp: 87. (F)
Period 1 RVP: 8.7   Period 2 RVP: 8.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
Cal. Year: 2005   Region: Low   Altitude: 500. Ft.
I/M Program: No   Ambient Temp: 84.1 / 84.1 / 84.1 F
Anti-tam. Program: No   Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.69	6.60	9.24	7.41	12.15	0.99	1.34	4.04	8.68	6.26
Exhst CO:	48.11	53.71	74.82	60.18	98.28	3.75	4.13	29.39	97.93	51.82
Exhst NOX:	1.61	1.91	2.62	2.13	3.79	1.76	1.96	12.43	0.79	2.63

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.59	1.84	2.53	2.05	3.67	0.43	0.58	1.75	4.29	1.81
Exhst CO:	14.61	17.07	23.45	19.02	26.78	1.11	1.23	8.73	18.31	15.77
Exhst NOX:	1.37	1.58	2.17	1.76	4.55	1.03	1.15	7.29	0.88	2.02

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	0.92	1.15	1.56	1.28	2.35	0.24	0.32	0.97	3.74	1.08
Exhst CO:	6.26	8.35	11.74	9.39	19.84	0.71	0.78	5.53	9.18	7.51
Exhst NOX:	1.74	2.03	2.80	2.27	5.71	1.35	1.49	9.49	1.36	2.59

Pearl Harbor (2005) Winter, No I/M Program
MOBILE5a (26-Mar-93)
Minimum Temp: 65. (F)   Maximum Temp: 79. (F)
Period 1 RVP: 8.7   Period 2 RVP: 8.7 Period 2 Yr: 1992
VOC HC emission factors include evaporative HC emission factors.

Emission factors are as of Jan. 1st of the indicated calendar year.
Cal. Year: 2005   Region: Low   Altitude: 500. Ft.
I/M Program: No   Ambient Temp: 76.0 / 76.0 / 76.0 F
Anti-tam. Program: No   Operating Mode: 20.6 / 27.3 / 20.6
Reformulated Gas: No

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	5.10	6.13	8.55	6.87	10.37	0.99	1.34	4.04	7.72	5.69
Exhst CO:	47.90	53.39	74.32	59.81	88.40	3.75	4.13	29.39	87.15	51.22
Exhst NOX:	1.60	1.89	2.60	2.11	3.78	1.76	1.96	12.43	0.84	2.62

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	1.48	1.73	2.39	1.93	3.04	0.43	0.58	1.75	3.29	1.68
Exhst CO:	14.55	16.98	23.32	18.92	24.09	1.11	1.23	8.73	16.30	15.61
Exhst NOX:	1.35	1.56	2.15	1.74	4.55	1.03	1.15	7.29	0.94	2.00

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Spd.:	55.0	55.0	55.0		55.0	55.0	55.0	55.0	55.0	
VMT Mix:	0.601	0.196	0.087		0.031	0.002	0.002	0.075	0.006	
Composite Emission Factors (Gm/Mile)										
VOC HC:	0.86	1.08	1.48	1.20	1.85	0.24	0.32	0.97	2.74	1.00
Exhst CO:	6.23	8.30	11.66	9.33	17.85	0.71	0.78	5.53	8.17	7.41
Exhst NOX:	1.72	2.01	2.78	2.25	5.70	1.35	1.49	9.49	1.45	2.57

APPENDIX A

HEALTH RISK ANALYSIS FOR PERMIT SOURCES ASSOCIATED WITH THE PREFERRED DREDGE/DISPOSAL OPTION

HEALTH RISK ANALYSIS FOR PERMIT SOURCES ASSOCIATED WITH THE PREFERRED DREDGE/DISPOSAL OPTION

1.0 INTRODUCTION

This health risk analysis is intended to determine the maximum potential carcinogenic and non-carcinogenic health risks that would occur due to emissions of hazardous air pollutants (HAPs) and toxic air contaminants (TACs) emitted from permitted sources associated with the preferred dredge/disposal option. The health risk of the permitted emission sources (i.e., the clamshell dredge, the hydraulic dredge, and the booster pump) are evaluated in order to determine the significance of the resulting impacts, as defined by the San Diego County Air Pollution Control District's (SDCAPCD) Rule 1200. Annual emission calculations for this analysis are based on the cumulative number of hours of operation required by all three sources to complete dredging and disposal activities. Short-term emission rate calculations used to determine acute exposures are based on the maximum hourly rate that would occur for a given hour. Since the clamshell dredge does not operate at the same time as the hydraulic dredge and booster pump, the maximum one-hour rate is the greater of the clamshell dredge hourly rate or the sum of the hydraulic dredge and booster pump hourly rates.

2.0 IDENTIFICATION OF HEALTH HAZARD

HAP/TAC emissions from diesel-powered dredge engines include acetaldehyde, acrolein, arsenic, benzene, 1,3-butadiene, cadmium, chromium, copper, formaldehyde, lead, manganese, mercury, naphthalene, nickel, polyaromatic hydrocarbons (PAH), selenium, toluene, xylene, and zinc. Table 1 lists the risk assessment requirements for each of these pollutants of concern.

Although all chromium compounds are regulated under the federal Clean Air Act Amendments of 1990, the particular form of chromium of concern in this assessment is hexavalent chromium (Cr^{+6}), due to its high toxicity and multipathway exposure potential. In this analysis all chromium is conservatively assumed to be present in the hexavalent form.

2.1 Cancer Risk

The U.S. Environmental Protection Agency (EPA) and the State of California consider acetaldehyde, arsenic, benzene, 1,3-butadiene, cadmium, chromium, formaldehyde, lead, nickel, PAH, and selenium to be known human carcinogens (CAPCOA, 1993). The State of California, as part of its toxics legislation requiring health risk analysis, has adopted unit risk factors (URFs) which are more conservative (health protective) than those adopted by EPA (CAPCOA, 1993). The more health-protective factors are used for this assessment.

As indicated in Table 1, the pollutants acetaldehyde, benzene, 1,3-butadiene, cadmium, formaldehyde, lead, nickel, and selenium are considered to contribute to exposure through the inhalation pathway only. A multi-pathway cancer risk analysis was performed for arsenic, chromium, and PAH emissions that included exposure through the inhalation, dermal absorption, soil ingestion, and homegrown plant ingestion pathways. Other potential exposure pathways such as water ingestion, crop ingestion, and fish ingestion were not considered for this analysis due to lack of applicability to this particular location and situation.

Table 1. Risk Assessment Requirements for HAP/TAC Emissions Associated with the Preferred Dredge/Disposal Option's Permitted Sources

Listed Substances	Averaging Period: Annual	Averaging Period: 1-Hour	Multi-Pathway Analysis	Cancer Risk	Non-Cancer Risk (Chronic)	Non-Cancer Risk (Acute)
Acetaldehyde	X			X	X	
Acrolein	X	X			X	X
Arsenic	X		X	X	X	
Benzene	X			X	X	
1,3-Butadiene	X			X		
Cadmium	X			X	X	
Chromium (VI)	X		X	X	X	
Copper	X	X			X	X
Formaldehyde	X	X		X	X	X
Lead	X			X	X	
Manganese	X				X	
Mercury	X	X			X	X
Naphthalene	X				X	
Nickel	X	X		X	X	X
PAH	X		X	X		
Selenium	X	X		X	X	X
Toluene	X				X	
Xylene	X	X			X	X
Zinc	X				X	

2.2 Non-Cancer Health Hazards

Acute and chronic non-cancer health impacts were evaluated for eight toxicological endpoints (target organs) including the respiratory system, the cardiovascular/blood system, the central nervous system, the reproductive system, the kidneys, the gastrointestinal/liver system, the immune system, and either the eye (acute only) or the skin (chronic only).

Table 2 details the toxicological endpoints that were considered in the acute and chronic health effects analyses. These endpoints are consistent with the recommendations of the State of California (CAPCOA, 1993).

3.0 EXPOSURE ASSESSMENT

3.1 Modeling Approach

A two-step approach was used to assess the health risk impacts from the preferred dredge/disposal option permit sources. First, an air dispersion model was used to simulate the emissions release from all sources and identify annual and maximum 1-hour ground-level concentrations. The EPA-approved ISC3 model was used for this purpose (EPA, 1995). Second, the ACE2588 model, a risk assessment model developed by the Santa Barbara County Air Pollution Control District (SBCAPCD) and approved by the California Air Pollution Control Officers Association (CAPCOA), was used with the output of the dispersion model to calculate pollutant-specific health risks (CAPCOA and SBCAPCD, 1992; 1993).

3.2 Dispersion Modeling Methodology

The two dredge sources (clamshell and hydraulic) were modeled as volume sources using dimensions and engine characteristics representative of the types of dredges available for use in the San Diego area (SDCAPCD, 1998; and personal communications with west coast dredging contractors). Volume sources were deemed to present the most appropriate characterization of the release of emissions since the dredge sources do not remain in a stationary location, but move slowly through an area defined by the dredge area boundaries. The booster pump was modeled as a stationary point source because the location its' power generator remains relatively fixed. Source characteristics for the booster pump generator were obtained through conversations with the distributor (personal communication with Ken Kaufman, Power Systems Associates). Source characteristics for each source are as shown in the ISC3 input file (see Attachment A) and on page 2 of the ISC3 output file (see Attachment B). The ISC3 model was run using a "normalized" release rate of 1.0 gram per second for each volume source to produce normalized annual and maximum 1-hour ground-level concentration (Chi over Q, X/Q) values.

Meteorological Data. Three full years of hour-by-hour meteorological data (1993, 1994, and 1995) were used in the ISC3 modeling process. The meteorological data for each year included 8,760 hourly values of windspeed, wind direction, ambient temperature, stability class, and mixing height. The stability class and mixing height data were obtained from upper air soundings performed at Montgomery Field in San Diego. The rest of the data were obtained from the meteorological monitoring station at San Diego International Airport. Modeling results from use of the year of data that produced the highest one-hour and annual impact values were selected for use in the risk model.

Table 2. Toxicological Endpoints Considered in the Acute and Chronic Hazard Index Assessments (page 1 of 2)

Acute Toxicity	Systems or Organs Affected							
	CV/BL	CNS	IMM	KIDN	GI/LV	REPR	RESP	EYE
Acrolein							X	
Copper							X	
Formaldehyde							X	
Mercury		X		X	X			
Nickel			X					
Selenium							X	
Xylene							X	

Chronic Toxicity	Systems or Organs Affected							
	CV/BL	CNS	IMM	KIDN	GI/LV	REPR	RESP	SKIN
Acetaldehyde							X	
Acrolein							X	
Arsenic	X	X					X	
Benzene		X						X
Cadmiuim				X			X	
Chromium (VI)				X	X		X	
Copper							X	
Formaldehyde							X	
Lead	X	X	X	X		X		
Manganese		X					X	
Mercury	X	X		X	X		X	

Table 2. Toxicological Endpoints Considered in the Acute and Chronic Hazard Index Assessments (page 2 of 2)

Chronic Toxicity	Systems or Organs Affected							
	CV/BL	CNS	IMM	KIDN	GI/LV	REPR	RESP	SKIN
Naphthalene	X							
Nickel			X	X			X	
Selenium							X	
Toluene		X				X		
Xylene						X	X	
Zinc	X						X	

Notes: CV/BL = cardiovascular system and blood system; CNS = central nervous system; IMM = immune system; KIDN = kidney; GI/LV = gastrointestinal system and liver; REPR = reproductive system (including teratogenic and developmental effects); and RESP = respiratory system.

Emission Rates. Actual HAP/TAC emission rates used in the risk model for each source were determined by applying emission factors (in pounds of pollutant per 1,000 gallons of fuel burned) to project-specific fuel use data. Development of the fuel use data is shown in Table C-1 and C-2 in Attachment C. The emission factors are provided in Table C-3. The factors for non-metal HAP/TACs were obtained from the EPA's AP-42 (EPA, 1996). Factors for the metals were obtained from the averages of various fuel analyses performed by the SDCAPCD (1998). A detailed list of annual and maximum 1-hour HAP/TAC emission rates for each source is provided in Table C-4 of Attachment C.

Receptor locations. Discrete receptor locations were used for this analysis. An irregularly shaped coarse grid of receptors was located around the operating locations of the dredges and booster pump with regular spacing between receptors of 500 meters in both the north-south and east-west directions. The grid extended as far as 5 kilometers (km) in the west direction, 3.5 km in both the north and south directions, and 7 km in the east direction from the dredge source locations. From the booster pump location the grid coverage extended 8.5 km to the west, 7.5 km north, 5.5 km south, and 7.5 km east. The entire grid completely covered North Island, including the communities of Coronado and Silver Strand, and provided sufficient depth of coverage onshore to ensure that the locations of maximum one-hour and annual impact were included in the ISC3 model results.

Following ISC3 model runs with the coarse grid for each of the years 1993 through 1995, one-hour and annual hot-spot locations were identified for further detailed fine-grid analysis. Regular 1.0 km by 1.0 km fine grids with 100 meter spacing between receptors (121 receptors) were centered around the coarse grid hot spot locations and the ISC3 model was rerun to ensure that the maximum one-hour and annual impact concentrations were located. The maximum fine-grid results for each year were then compared and it was determined that the year 1995 produced the highest impact concentrations. The normalized impact concentrations from the year 1995 maximum one-hour and annual impact locations were therefore used as the input to the risk model (see Attachment B for the ISC3 output file results for year 1995).

3.3 Risk Characterization

The ACE2588 (Version 93288) Risk Assessment Computer Model was used to determine cancer risk and non-cancer acute and chronic health hazard impacts (SBCAPCD and CAPCOA 1992; 1993). ACE2588 is a risk assessment model that performs multi-pathway analysis of cancer risk and evaluation of non-cancer acute and chronic health hazards according to methods approved by CAPCOA (CAPCOA 1993).

Cancer Risk. Results of the ACE2588 model for maximum cancer risk are shown by pollutant for each exposure pathway in Table 3 (see also the ACE2588 output file for year 1995 in Attachment D). The maximum individual cancer risk results in Table 3 are based on the continuous operation of all three permit sources and continuous individual exposure for 70 years, 365 days per year, 24 hours per day.

Table 3. Maximum Cancer Risk Results for 70-Year Operation of the Permit Sources Associated with the Preferred Dredging/Disposal Option

	Cancer Risk (x 10^{-6})				
Pollutant	**Inhalation**	**Dermal Absorption**	**Soil Ingestion**	**Plant Ingestion**	**Total[a]**
Acetaldehyde	<0.001	NA	NA	NA	<0.001
Arsenic	0.158	0.004	0.211	0.088	0.461
Benzene	0.019	NA	NA	NA	0.019
1,3-Butadiene	0.006	NA	NA	NA	0.006
Cadmium	0.032	NA	NA	NA	0.032
Chromium (VI)	0.172	<0.001	0.001	<0.001	0.174
Formaldehyde	<0.001	NA	NA	NA	<0.001
Lead	0.002	NA	NA	NA	0.002
Nickel	0.004	NA	NA	NA	0.004
PAH	0.200	0.190	0.300	2.180	2.871
Selenium	0.008	NA	NA	NA	0.008
Total	**0.601**	**0.195**	**0.512**	**2.269**	**3.577**

Note: (a) Cancer risk values based on 70 years of emissions and exposure, 365 days per year, 24 hours per day.

Table 3 shows that the maximum total cancer risk would be 3.58×10^{-6}. This equates to a maximum chance of 3.6 in a million of contracting cancer due to a continuous exposure to the permitted source emissions for 70 years. However, the preferred dredge and disposal operations would actually only last for about 3 months, not 70 years. Therefore, assuming as a worst case that these activities occurred for a period of one year, a more realistic estimate of risk would be $3.58 \times 10^{-6} / 70 = 5.11 \times 10^{-8}$ (or 0.05 chances in a million). This value is well below the significance threshold established by SDCAPCD Rule 1200 of one chance per million. As shown in Table 3, the majority of the risk (98 percent) is contributed by the emissions of three pollutants: PAH (80 percent), arsenic (13 percent), and chromium (5 percent).

Non-Cancer Acute Health Effects. Results of the ACE2588 model for non-cancer acute health effects are shown by pollutant in Table 4. The maximum acute hazard index predicted by the ACE2588 occurs for the respiratory system endpoint (maximum acute hazard index = 0.022).

Non-Cancer Chronic Health Effects. Results of the ACE2588 model for non-cancer chronic health effects are shown by pollutant in Table 5. Like the acute hazard index, the maximum predicted chronic hazard index also occurs for the respiratory system endpoint (maximum chronic hazard index = 0.0014).

4.0 CONCLUSIONS

The SDCAPCD has determined that a maximum cancer risk less than 1×10^{-6} (one chance per million) is acceptable in terms of indicating that an insignificant amount of cancer health risk would occur (see SDCAPCD Rule 1200). The SDCAPCD has also set maximum acceptable hazard indices for both acute and chronic non-cancer health effects. Acute or chronic hazard indices below 1.0 are considered to present insignificant health risks. These threshold values are in accordance with guidance from CAPCOA. Based on these criteria, emissions of HAPs/TACs contained in the combustion products released by the permit sources associated with the preferred dredge/disposal option (i.e., the clamshell dredge, hyraulic dredge, and booster pump) would present insignificant cancer and non-cancer health risks to the workers and general population in the area of the dredge/disposal activities (maximum cancer risk = 0.05 chance in a million; maximum acute hazard index = 0.022; and maximum chronic hazard index = 0.0014).

Table 4. Maximum Acute and Chronic Hazard Indices Predicted for Various Toxicological Endpoints (page 1 of 2)

Pollutant	Acute Hazard Index							
	CV/BL	CNS	IMM	KIDN	GI/LV	REPR	RESP	EYE
Acrolein	NA	NA	NA	NA	NA	NA	0.0017	NA
Copper	NA	NA	NA	NA	NA	NA	0.0014	NA
Formaldehyde	NA	NA	NA	NA	NA	NA	0.0001	NA
Mercury	NA	0.0003	NA	0.0003	0.0003	NA	NA	NA
Nickel	NA	NA	0.0088	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	0.0190	NA
Xylene	NA	NA	NA	NA	NA	NA	<0.0001	NA
Total	**NA**	**0.0003**	**0.0088**	**0.0003**	**0.0003**	**NA**	**0.0222**	**NA**

Pollutant	Chronic Hazard Index							
	CV/BL	CNS	IMM	KIDN	GI/LV	REPR	RESP	SKIN
Acetaldehyde	NA	NA	NA	NA	NA	NA	<0.0001	NA
Acrolein	NA	NA	NA	NA	NA	NA	0.0004	NA
Arsenic	0.0003	0.0003	NA	NA	NA	NA	<0.0001	NA
Benzene	NA	<0.0001	NA	NA	NA	NA	NA	0.0003
Cadmiuim	NA	NA	NA	<0.0001	NA	NA	<0.0001	NA
Chromium (VI)	NA	NA	NA	0.0006	0.0006	NA	0.0006	NA
Copper	NA	NA	NA	NA	NA	NA	<0.0001	NA
Formaldehyde	NA	NA	NA	NA	NA	NA	<0.0001	NA
Lead	0.0003	0.0003	0.0003	0.0003	NA	0.0003	NA	NA
Manganese	NA	<0.0001	NA	NA	NA	NA	<0.0001	NA

Table 4. Maximum Acute and Chronic Hazard Indices Predicted for Various Toxicological Endpoints (page 2 of 2)

Pollutant	Chronic Hazard Index							
	CV/BL	CNS	IMM	KIDN	GI/LV	REPR	RESP	SKIN
Mercury	0.0003	0.0003	NA	0.0003	0.0003	NA	<0.0001	NA
Naphthalene	<0.0001	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	<0.0001	<0.0001	NA	NA	<0.0001	NA
Selenium	NA	NA	NA	NA	NA	NA	0.0001	NA
Toluene	NA	<0.0001	NA	NA	NA	<0.0001	NA	NA
Xylene	NA	NA	NA	NA	NA	<0.0001	<0.0001	NA
Zinc	<0.0001	NA	NA	NA	NA	NA	<0.0001	NA
Total	**0.0009**	**0.0009**	**0.0003**	**0.0013**	**0.0010**	**0.0003**	**0.0014**	**0.0003**

Notes: CV/BL = cardiovascular system and blood system; CNS = central nervous system; IMM = immune system; KIDN = kidney; GI/LV = gastrointestinal system and liver; REPR = reproductive system (including teratogenic and developmental effects); RESP = respiratory system; and NA = not applicable.

REFERENCES

California Air Pollution Control Officers Association (CAPCOA), January 1993. *Risk Assessment Guidelines: Air Toxics "Hot Spots" Program*. AB 2588 Risk Assessment Committee of CAPCOA, Air Resources Board, California.

San Diego County Air Pollution Control District (SDCAPCD), February 1998. *Air Quality Impact Analysis – Final Report – Original Dredge Disposal Plan for San Diego Bay*. Monitoring and Technical Services, SDCAPCD, San Diego, California.

Santa Barbara County County Air Pollution Control District (SBCAPCD) and California Air Pollution Control Officers Association (CAPCOA), November 1992. *User's Guide to the Assessment of Chemical Exposure for AB 2588 (ACE 2588) Computer Model.*

______, October 1993: *ACE2588/ACE2 Upgrade Package - Version 93288.*

U.S. Environmental Protection Agency (EPA), September 1995: *User's Guide for the Industrial Source Complex (ISC3) Dispersion Models, Volume I - User Instructions*, EPA-450/B-95-003a. Office of Air Quality Planning and Standards, U.S.EPA, Research Triangle Park, North Carolina.

_____, 1996. *Compilation of Air Pollutant Emission Factors (AP-42), Volume I: Stationary Point and Area Sources.* Office of Air Quality Planning and Standards, U.S.EPA, Research Triangle Park, North Carolina.

ATTACHMENT A

ISC3 Model Input File

(Note: The ISC3 input file used to model impacts at the maximum one-hour and annual receptor locations for the year 1995 is included in this Attachment. Year 1995 was determined to present the worst-case impacts. Input files for the coarse grid and fine grid runs used to determine the maximum one-hour and annual impact locations for each of the years 1993, 1994, and 1995 are also available upon request. In addition, the input files used to model impacts at the maximum one-hour and annual receptor locations for the years 1993 and 1994 are available as well. To arrange receipt of any of these other files, please contact Steve Ziemer or Chris Crabtree at:

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ziemers@saic.com or crabtreec@saic.com

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CO STARTING
CO TITLEONE HEALTH ANALYSIS - HOMEPORTING DREDGE SOURCES - 1995
CO MODELOPT  CONC  RURAL
CO AVERTIME  PERIOD  1
CO POLLUTID  OTHER
CO TERRHGTS  ELEV
**CO ELEVUNIT  FEET
CO DCAYCOEF    000.000
CO RUNORNOT  RUN
CO ERRORFIL  ERRORS.OUT
CO FINISHED

SO STARTING
** Source Location Cards:
**          SRCID    SRCTYP     XS       YS      ZS
SO LOCATION BP       POINT    485450   615500  3.05
SO LOCATION CSD      VOLUME   482220   619350  0.00
SO LOCATION HD       VOLUME   482000   619550  0.00

** Source Parameter Cards:
** POINT:   SRCID        QS      HS     TEMP     VEL   DIAM
SO SRCPARAM BP          1.00    4.57   812.0    52.3   0.36
** VOLUME:  SRCID        QS      HS    SYINIT   SZINIT
SO SRCPARAM CSD         1.00   12.50    9.30    11.63
SO SRCPARAM HD          1.00    8.38   11.63     7.80

SO EMISUNIT  .100000E+07  (GRAMS/SEC)   (MICROGRAMS/CUBIC-METER)
SO SRCGROUP  1  CSD
SO SRCGROUP  2  HD
SO SRCGROUP  3  BP
** SO SRCGROUP  ALL
SO FINISHED

RE STARTING
RE ELEVUNIT FEET
RE DISCCART  481500.  620500.   10.0
RE DISCCART  482200.  618500.   20.0
RE FINISHED

ME STARTING
ME INPUTFIL  C:\ISC3\ISC-ACE\SANMIR95.MET
ME ANEMHGHT  10.0  METERS
ME SURFDATA  23188  1995     SANDIEGO
ME UAIRDATA   3190  1995     SOUNDINGS
ME STARTEND  95  01  01  1  95  12  31  24
ME FINISHED

OU STARTING
OU RECTABLE  1  FIRST
OU POSTFILE  1        1  UNFORM  pcon.bin              20
OU POSTFILE  1        2  UNFORM  pcon.bin              20
OU POSTFILE  1        3  UNFORM  pcon.bin              20
OU POSTFILE  PERIOD   1  UNFORM  pcon.bin              20
OU POSTFILE  PERIOD   2  UNFORM  pcon.bin              20
OU POSTFILE  PERIOD   3  UNFORM  pcon.bin              20
OU FINISHED
```

ATTACHMENT B

ISC3 Model Output File

(Note: The ISC3 output file produced by the modeling of impacts at the maximum one-hour and annual receptor locations for the year 1995 is included in this Attachment. Year 1995 was determined to present the worst-case impacts. Output files from the coarse grid and fine grid modeling runs used to determine the maximum one-hour and annual impact locations for each of the years 1993, 1994, and 1995 are also available upon request. In addition, the output files from modeling of the impacts at the maximum one-hour and annual receptor locations for the years 1993 and 1994 are available as well. To arrange receipt of any of these other files, please contact Steve Ziemer or Chris Crabtree at:

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(805) 966-0811

Or, by e-mail:

ziemers@saic.com or crabtreec@saic.com

```
**MODELOPTs: CONC                          RURAL  ELEV

                                    ***     MODEL SETUP OPTIONS SUMMARY       ***
          - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

**Intermediate Terrain Processing is Selected

**Model Is Setup For Calculation of Average CONCentration Values.

  -- SCAVENGING/DEPOSITION LOGIC --
**Model Uses NO DRY DEPLETION.  DDPLETE =  F
**Model Uses NO WET DEPLETION.  WDPLETE =  F
**NO WET SCAVENGING Data Provided.
**Model Does NOT Use GRIDDED TERRAIN Data for Depletion Calculations

**Model Uses RURAL Dispersion.

**Model Uses User-Specified Options:
          1. Final Plume Rise.
          2. Stack-tip Downwash.
          3. Buoyancy-induced Dispersion.
          4. Calms Processing Routine.
          5. Not Use Missing Data Processing Routine.
          6. Default Wind Profile Exponents.
          7. Default Vertical Potential Temperature Gradients.

**Model Accepts Receptors on ELEV Terrain.

**Model Assumes No FLAGPOLE Receptor Heights.

**Model Calculates  1 Short Term Average(s) of:   1-HR
    and Calculates PERIOD Averages

**This Run Includes:     3 Source(s);       3 Source Group(s); and       2 Receptor(s)

**The Model Assumes A Pollutant Type of:  OTHER

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:
         Model Outputs Tables of PERIOD Averages by Receptor
         Model Outputs Tables of Highest Short Term Values by Receptor (RECTABLE Keyword)
         Model Outputs External File(s) of Concurrent Values for Postprocessing (POSTFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Anem. Hgt. (m) =    10.00 ;    Decay Coef. =   0.0000      ;    Rot. Angle =     0.0
                 Emission Units = (GRAMS/SEC)                               ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = (MICROGRAMS/CUBIC-METER)

**Input Runstream File: DR95iscM.inp                       ;  **Output Print File: DR95iscM.out
**Detailed Error/Message File:   ERRORS.OUT
```

**MODELOPTs: CONC   RURAL ELEV

*** POINT SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (USER UNITS)	X (METERS)	Y (METERS)	BASE ELEV. (METERS)	STACK HEIGHT (METERS)	STACK TEMP. (DEG.K)	STACK EXIT VEL. (M/SEC)	STACK DIAMETER (METERS)	BUILDING EXISTS	EMISSION RATE SCALAR VARY BY
BP	0	0.10000E+01	485450.0	615500.0	3.0	4.57	812.00	52.30	0.36	NO	

**MODELOPTs: CONC   RURAL ELEV

*** VOLUME SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (USER UNITS)	X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	INIT. SY (METERS)	INIT. SZ (METERS)	EMISSION RATE SCALAR VARY BY
CSD	0	0.10000E+01	482220.0	619350.0	0.0	12.50	9.30	11.63	
HD	0	0.10000E+01	482000.0	619550.0	0.0	8.38	11.63	7.80	

**MODELOPTs: CONC   RURAL ELEV

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
1	CSD ,
2	HD ,
3	BP ,

**MODELOPTs: CONC   RURAL ELEV

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(481500.0, 620500.0, 3.0, 0.0); (482200.0, 618500.0, 6.1, 0.0);

**MODELOPTs: CONC   RURAL ELEV

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1
```

METEOROLOGICAL DATA PROCESSED BETWEEN START DATE: 95 1 1 1
AND END DATE: 95 12 31 24

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** WIND PROFILE EXPONENTS ***

STABILITY	WIND SPEED CATEGORY					
CATEGORY	1	2	3	4	5	6
A	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
B	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
C	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00
D	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00
E	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00
F	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00

*** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
(DEGREES KELVIN PER METER)

STABILITY	WIND SPEED CATEGORY					
CATEGORY	1	2	3	4	5	6
A	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
B	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
C	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
D	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
E	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01
F	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01

**MODELOPTs: CONC RURAL ELEV

*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FILE: C:\ISC3\ISC-ACE\SANMIR95.MET FORMAT: (4I2,2F9.4,F6.1,I2,2F7.1,f9.4,f10.1,f8.4,i4,f7.2)
SURFACE STATION NO.: 23188 UPPER AIR STATION NO.: 3190
NAME: SANDIEGO NAME: SOUNDINGS
YEAR: 1995 YEAR: 1995

YR	MN	DY	HR	FLOW VECTOR	SPEED (M/S)	TEMP (K)	STAB CLASS	MIXING HEIGHT (M) RURAL	URBAN	USTAR (M/S)	M-O LENGTH (M)	Z-0 (M)	IPCODE	PRATE (mm/HR)
95	1	1	1	171.0	2.57	284.3	5	940.7	339.0	0.0000	0.0	0.0000	0	0.00
95	1	1	2	178.0	2.57	284.3	5	941.8	339.0	0.0000	0.0	0.0000	0	0.00
95	1	1	3	184.0	2.06	284.3	5	943.0	339.0	0.0000	0.0	0.0000	0	0.00
95	1	1	4	23.0	2.06	284.8	5	944.2	339.0	0.0000	0.0	0.0000	0	0.00
95	1	1	5	133.0	3.09	283.7	5	945.4	339.0	0.0000	0.0	0.0000	0	0.00
95	1	1	6	142.0	2.06	282.6	5	946.6	339.0	0.0000	0.0	0.0000	0	0.00
95	1	1	7	185.0	2.57	282.6	4	9.8	345.3	0.0000	0.0	0.0000	0	0.00
95	1	1	8	183.0	3.09	282.6	4	145.0	432.6	0.0000	0.0	0.0000	0	0.00
95	1	1	9	167.0	2.57	287.0	4	280.2	519.8	0.0000	0.0	0.0000	0	0.00
95	1	1	10	171.0	5.14	288.2	4	415.3	607.1	0.0000	0.0	0.0000	0	0.00
95	1	1	11	124.0	4.63	289.3	3	550.5	694.3	0.0000	0.0	0.0000	0	0.00
95	1	1	12	126.0	4.63	290.4	3	685.7	781.5	0.0000	0.0	0.0000	0	0.00
95	1	1	13	123.0	6.17	289.8	4	820.8	868.8	0.0000	0.0	0.0000	0	0.00
95	1	1	14	129.0	6.69	289.3	4	956.0	956.0	0.0000	0.0	0.0000	0	0.00
95	1	1	15	122.0	5.66	289.3	4	956.0	956.0	0.0000	0.0	0.0000	0	0.00
95	1	1	16	124.0	5.14	288.7	4	956.0	956.0	0.0000	0.0	0.0000	0	0.00
95	1	1	17	121.0	3.60	287.6	5	952.7	936.5	0.0000	0.0	0.0000	0	0.00
95	1	1	18	127.0	3.09	286.5	6	935.5	834.8	0.0000	0.0	0.0000	0	0.00
95	1	1	19	144.0	2.57	285.4	6	918.2	733.2	0.0000	0.0	0.0000	0	0.00
95	1	1	20	167.0	2.06	285.4	6	901.0	631.6	0.0000	0.0	0.0000	0	0.00
95	1	1	21	190.0	2.06	284.8	6	883.8	529.9	0.0000	0.0	0.0000	0	0.00
95	1	1	22	252.0	2.06	284.8	6	866.6	428.3	0.0000	0.0	0.0000	0	0.00
95	1	1	23	280.0	2.06	283.7	6	849.4	326.6	0.0000	0.0	0.0000	0	0.00
95	1	1	24	270.0	2.06	284.3	6	832.1	225.0	0.0000	0.0	0.0000	0	0.00

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

**MODELOPTs: CONC   RURAL ELEV

*** THE PERIOD (8760 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: 1 ***
INCLUDING SOURCE(S): CSD ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
481500.00	620500.00	0.27943	482200.00	618500.00	3.33053

**MODELOPTs: CONC   RURAL ELEV

*** THE PERIOD (8760 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: 2 ***
INCLUDING SOURCE(S): HD ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
481500.00	620500.00	0.54379	482200.00	618500.00	2.75158

**MODELOPTs: CONC RURAL ELEV

*** THE PERIOD (8760 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: 3 ***
INCLUDING SOURCE(S): BP ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
481500.00	620500.00	0.02092	482200.00	618500.00	0.03326

**MODELOPTs: CONC   RURAL ELEV

*** THE 1ST HIGHEST 1-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: 1 ***
INCLUDING SOURCE(S): CSD ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

X-COORD (M)	Y-COORD (M)	CONC	(YYMMDDHH)	X-COORD (M)	Y-COORD (M)	CONC	(YYMMDDHH)
481500.00	620500.00	130.69441	(95032402)	482200.00	618500.00	367.71252	(95081902)

**MODELOPTs: CONC   RURAL ELEV

*** THE 1ST HIGHEST 1-HR AVERAGE CONCENTRATION   VALUES FOR SOURCE GROUP: 2   ***
INCLUDING SOURCE(S):   HD   ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER   IN (MICROGRAMS/CUBIC-METER)   **

X-COORD (M)	Y-COORD (M)	CONC	(YYMMDDHH)	X-COORD (M)	Y-COORD (M)	CONC	(YYMMDDHH)
481500.00	620500.00	236.27216	(95030906)	482200.00	618500.00	252.20995	(95100506)

```
*** ISCST3 - VERSION 97363 ***    *** HEALTH ANALYSIS - HOMEPORTING DREDGE SOURCES - 1995                  ***      05/17/99
                                  ***                                                                      ***      11:54:14
                                                                                                                    PAGE  13
**MODELOPTs: CONC                             RURAL  ELEV

                            *** THE   1ST HIGHEST  1-HR AVERAGE CONCENTRATION   VALUES FOR SOURCE GROUP:  3        ***
                                INCLUDING SOURCE(S):      BP       ,

                                          *** DISCRETE CARTESIAN RECEPTOR POINTS ***

                                     ** CONC OF OTHER    IN (MICROGRAMS/CUBIC-METER)                 **

    X-COORD (M)  Y-COORD (M)        CONC      (YYMMDDHH)              X-COORD (M)  Y-COORD (M)        CONC      (YYMMDDHH)
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
       481500.00    620500.00       10.52509  (95032504)                482200.00    618500.00       15.87355  (95042505)
```

**MODELOPTs: CONC RURAL ELEV

*** THE SUMMARY OF MAXIMUM PERIOD (8760 HRS) RESULTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG) OF TYPE					NETWORK GRID-ID
1	1ST HIGHEST VALUE IS	3.33053 AT (	482200.00,	618500.00,	6.10,	0.00)	DC	NA
	2ND HIGHEST VALUE IS	0.27943 AT (	481500.00,	620500.00,	3.05,	0.00)	DC	NA
2	1ST HIGHEST VALUE IS	2.75158 AT (	482200.00,	618500.00,	6.10,	0.00)	DC	NA
	2ND HIGHEST VALUE IS	0.54379 AT (	481500.00,	620500.00,	3.05,	0.00)	DC	NA
3	1ST HIGHEST VALUE IS	0.03326 AT (	482200.00,	618500.00,	6.10,	0.00)	DC	NA
	2ND HIGHEST VALUE IS	0.02092 AT (	481500.00,	620500.00,	3.05,	0.00)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

**MODELOPTs: CONC RURAL ELEV

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

GROUP ID		AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
1	HIGH 1ST HIGH VALUE IS	367.71252	ON 95081902: AT (	482200.00,	618500.00,	6.10,	0.00)	DC	NA
2	HIGH 1ST HIGH VALUE IS	252.20995	ON 95100506: AT (	482200.00,	618500.00,	6.10,	0.00)	DC	NA
3	HIGH 1ST HIGH VALUE IS	15.87355	ON 95042505: AT (	482200.00,	618500.00,	6.10,	0.00)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

**MODELOPTs: CONC   RURAL ELEV

```
*** Message Summary : ISCST3 Model Execution ***

 --------- Summary of Total Messages --------

A Total of           0 Fatal Error Message(s)
A Total of           1 Warning Message(s)
A Total of         715 Informational Message(s)

A Total of         715 Calm Hours Identified

   ******** FATAL ERROR MESSAGES ********
              ***  NONE  ***

   ********   WARNING MESSAGES   ********
SO W320    22 PPARM :Source Parameter May Be Out-of-Range for Parameter      VS

   ************************************
   *** ISCST3 Finishes Successfully ***
   ************************************
```

ATTACHMENT C

Development of Source Emission Rates

Table C-1. Emission Source Data Associated with Clamshell Dredging at the Piers J/K CVN Berth.

Construction Activity/Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel (1000 Gal)*
Dredge Dike Footing with Clamshell (1)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	24	66	48.5
Dredge - Main Generator	900	0.50	1	450	23.0	24	66	36.4
Dredge - Deck Generator	240	0.60	1	144	7.3	5	66	2.4
Rock Placement - Clamshell (2)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	8	7	1.6
Dredge - Main Generator	900	0.50	1	450	23.0	8	7	1.2
Dredge - Deck Generator	240	0.60	1	144	7.3	2	7	0.1

(1) Based on a daily dredging rate of 3,333 cubic yards (cy), or 4,000 cy with a 1.2 bulk factor. Total dredging volume for the dike footing would be 220,000 cy, or 264,000 cy with a 1.2 bulk factor.

(2) Based on a daily/total placement rate of 6,000/39,500 tons.

Table C-2. Emission Source Data Associated with Hydraulic Dredging at the Piers J/K CVN Berth.

Construction Activity/Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel (1000 Gal)*
Hydraulic Dredging (1)								
Generator	1,500	0.80	2	2,400	122.4	24	16	46.1
Disposal at CAD-1								
Booster Pump	2,000	0.80	1	1,600	81.6	24	16	30.7

(1) Based on a daily/total dredging rate of 20,000/314,000 cy, dry.

Table C-3. **Hazardous Air Pollutant (HAP) and Toxic Air Contaminant (TAC) Emission Factors for Dredge Sources at NASNI - CVN Homeporting Project.**

Source Type	EMISSION FACTOR (POUNDS/1000 GALLONS)									
	Acetaldehyde	*Acrolein*	*Arsenic*	*Benzene*	*1,3-Butadiene*	*Cadmium*	*Chromium (VI)*	*Copper*	*Formaldehyde*	*Lead*
IC Engine (>600 Hp)	3.53E-03	1.10E-03	7.80E-03	1.08E-01	5.47E-03	1.20E-03	2.00E-04	3.60E-03	1.10E-02	4.80E-03
IC Engine (<600 Hp)	1.07E-01	1.30E-02	7.80E-03	1.31E-01	5.47E-03	1.20E-03	2.00E-04	3.60E-03	1.65E-01	4.80E-03

Source Type	EMISSION FACTOR (POUNDS/1000 GALLONS)									
	Manganese	*Mercury*	*Naphthalene*	*Nickel*	*PAH*	*Propylene*	*Selenium*	*Toluene*	*Xylene*	*Zinc*
IC Engine (>600 Hp)	1.40E-03	2.30E-03	1.82E-02	2.30E-03	2.97E-02	3.91E-01	9.60E-03	3.93E-02	2.70E-02	1.43E-02
IC Engine (<600 Hp)	1.40E-03	2.30E-03	1.19E-02	2.30E-03	2.35E-02	3.61E-01	9.60E-03	5.73E-02	3.99E-02	1.43E-02

Sources: AP-42 (Tables 3.3-1, 3.3-2, 3.4-1, 3.4-2, 3.4-3, and 3.4-4) and averages of fuel analyses submitted to San Diego County APCD. (EPA, 1996) and (San Diego County APCD, 1998).

Table C-4. Peak Hour and Annualized HAP/TAC Emission Rates for Dredge Sources at NASNI - CVN Homeporting Project.

Source/ Averaging Period	EMISSION RATE (G/SEC)									
	Acetaldehyde	*Acrolein*	*Arsenic*	*Benzene*	*1,3-Butadiene*	*Cadmium*	*Chromium (VI)*	*Copper*	*Formaldehyde*	*Lead*
CSD - Peak Hour	1.2E-04	1.9E-05	6.0E-05	8.5E-04	4.2E-05	9.2E-06	1.5E-06	2.8E-05	2.3E-04	3.7E-05
CSD - Annual	8.3E-06	1.9E-06	1.0E-05	1.4E-04	7.1E-06	1.6E-06	2.6E-07	4.7E-06	2.0E-05	6.2E-06
HD - Peak Hour	5.4E-05	1.7E-05	1.2E-04	1.7E-03	8.4E-05	1.9E-05	3.1E-06	5.6E-05	1.7E-04	7.4E-05
HD - Annual	2.3E-06	7.3E-07	5.2E-06	7.2E-05	3.6E-06	8.0E-07	1.3E-07	2.4E-06	7.3E-06	3.2E-06
BP - Peak Hour	3.6E-05	1.1E-05	8.0E-05	1.1E-03	5.6E-05	1.2E-05	2.1E-06	3.7E-05	1.1E-04	4.9E-05
BP - Annual	1.6E-06	4.9E-07	3.4E-06	4.8E-05	2.4E-06	5.3E-07	8.8E-08	1.6E-06	4.9E-06	2.1E-06
Max Peak Hour (1)	**1.2E-04**	**2.8E-05**	**2.0E-04**	**2.8E-03**	**1.4E-04**	**3.1E-05**	**5.1E-06**	**9.3E-05**	**2.8E-04**	**1.2E-04**
Max Annual (2)	**1.1E-05**	**3.1E-06**	**1.9E-05**	**2.6E-04**	**1.3E-05**	**2.9E-06**	**4.8E-07**	**8.6E-06**	**3.2E-05**	**1.2E-05**
Source/ Averaging Period	EMISSION RATE (G/SEC)									
	Manganese	*Mercury*	*Naphthalene*	*Nickel*	*PAH*	*Propylene*	*Selenium*	*Toluene*	*Xylene*	*Zinc*
CSD - Peak Hour	1.1E-05	1.8E-05	1.3E-04	1.8E-05	2.2E-04	3.0E-03	7.4E-05	3.2E-04	2.2E-04	1.1E-04
CSD - Annual	1.8E-06	3.0E-06	2.3E-05	3.0E-06	3.8E-05	5.1E-04	1.2E-05	5.2E-05	3.5E-05	1.9E-05
HD - Peak Hour	2.2E-05	3.5E-05	2.8E-04	3.5E-05	4.6E-04	6.0E-03	1.5E-04	6.1E-04	4.2E-04	2.2E-04
HD - Annual	9.3E-07	1.5E-06	1.2E-05	1.5E-06	2.0E-05	2.6E-04	6.4E-06	2.6E-05	1.8E-05	9.5E-06
BP - Peak Hour	1.4E-05	2.4E-05	1.9E-04	2.4E-05	3.1E-04	4.0E-03	9.9E-05	4.0E-04	2.8E-04	1.5E-04
BP - Annual	6.2E-07	1.0E-06	8.0E-06	1.0E-06	1.3E-05	1.7E-04	4.2E-06	1.7E-05	1.2E-05	6.3E-06
Max Peak Hour (1)	**3.6E-05**	**5.9E-05**	**4.7E-04**	**5.9E-05**	**7.6E-04**	**1.0E-02**	**2.5E-04**	**1.0E-03**	**6.9E-04**	**3.7E-04**
Max Annual (2)	**3.4E-06**	**5.5E-06**	**4.3E-05**	**5.5E-06**	**7.1E-05**	**9.4E-04**	**2.3E-05**	**9.5E-05**	**6.5E-05**	**3.4E-05**

(1) The clamshell dredge does not operate at the same time that the hydraulic dredge and booster pump operates. Therefore, the maximum hourly emission rate is the greater of the clamshell dredge hourly rate or the sum of the hydraulic dredge and booster pump hourly rates.

(2) The maximum annual emission rate is the sum of the clamshell dredge, hydraulic dredge, and booster pump annual emission rates.

CSD = Clamshell Dredge HD = Hydraulic Dredge

ATTACHMENT D

ACE2588 Model Output File

***** A C E 2 5 8 8 --- ASSESSMENT OF CHEMICAL EXPOSURE FOR AB 2588 --- VERSION 93288-ACE2 *****

*** A MULTI-SOURCE, MULTI-POLLUTANT, MULTI-PATHWAY RISK ASSESSMENT MODEL

DEVELOPED BY APPLIED MODELING INC. AND SANTA BARBARA COUNTY APCD ***

Distributed and Maintained by CAPCOA

*** INPUT MODELING PARAMETERS ***

DISPERSION MODELING OPTION =	1
RISK ASSESSMENT OPTION =	0
NONCANCER ACUTE OPTION =	1
DIAGNOSTIC PRINT OUTPUT OPTION =	1
NUMBER OF RECEPTORS =	2
NUMBER OF SOURCES =	3
NUMBER OF POLLUTANTS =	20
NUMBER OF DISPERSION MODELING HOURS =	8760
NUMBER OF DISPERSION MODELING DAYS =	365

IDODIS = 1 ==> ISCST DISPERSION MODELING WITH SEQUENTIAL METEOROLOGY
ANNUAL CONCENTRATIONS COMPUTED AS AVERAGES OF 1-HOUR CONC.

IDORISK = 0 ==> FULL MODEL RUN FOR RISK ASSESSMENT FROM ALL SOURCES AT ALL RECEPTORS

IDOACU = 1 ==> NONCANCER ACUTE EXPOSURE PERFORMED

IDOPRT = 1 ==> DIAGNOSTIC PRINT OUTPUT CREATED

IDENTIFICATION NUMBERS OF MODELED POLLUTANTS:

1 3 10 13 20 22 36 38 70 83 85 87 110 111 130
134 137 145 151 152

*** POLLUTANT-SPECIFIC DATA ***

NAME	SYMBOL	NUM	UNIT RISK (ug/m3)-1	POTENCY (mg/kg-d)-1	ACUTE AEL (ug/m3)	CHRONIC AEL (ug/m3)	ORAL DOSE (mg/kg-d)	CHRONIC TOX ENDPOINTS CV	CN	IM	KI	LI	RP	RE	SK	ACUTE TOX ENDPOINTS CV	CN	IM	KI	LI	RP	RE	EY
Acetaldehyde	ACETA	1	2.70E-06	0.00E+00	0.00E+00	9.00E+00	0.00E+00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Acrolein	ACROL	3	0.00E+00	0.00E+00	2.50E+00	2.00E-02	0.00E+00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Arsenic	As	10	3.30E-03	1.70E+00	0.00E+00	5.00E-01	1.00E-03	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Benzene	BENZE	13	2.90E-05	0.00E+00	0.00E+00	7.10E+01	0.00E+00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Butadiene-1,3	BUTAD	20	1.70E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cadmium	Cd	22	4.20E-03	0.00E+00	0.00E+00	3.50E+00	1.00E-03	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Chromium (hex.)	Cr	36	1.40E-01	4.20E-01	0.00E+00	2.00E-03	5.00E-03	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
Copper	Cu	38	0.00E+00	0.00E+00	1.00E+01	2.40E+00	0.00E+00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Formaldehyde	HCHO	70	6.00E-06	0.00E+00	3.70E+02	3.60E+00	0.00E+00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Lead	Pb	83	8.00E-05	0.00E+00	0.00E+00	1.50E+00	4.30E-04	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
Manganese	Mn	85	0.00E+00	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Mercury	Hg	87	0.00E+00	0.00E+00	3.00E+01	3.00E-01	3.00E-04	1	1	0	1	1	0	1	0	0	1	0	1	1	0	0	0
Naphthalene	NAPTH	110	0.00E+00	0.00E+00	0.00E+00	1.40E+01	4.00E-03	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel	Ni	111	2.60E-04	0.00E+00	1.00E+00	2.40E-01	0.00E+00	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0
Polycyclic arom. HC	PAH	130	1.10E-03	1.20E+01	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Propylene	PROPL	134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Selenium	Se	137	1.40E-04	0.00E+00	2.00E+00	5.00E-01	0.00E+00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Toluene	TOL	145	0.00E+00	0.00E+00	0.00E+00	2.00E+02	0.00E+00	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Xylene	XYLEN	151	0.00E+00	0.00E+00	4.40E+03	3.00E+02	0.00E+00	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
Zinc	Zn	152	0.00E+00	0.00E+00	0.00E+00	3.50E+01	0.00E+00	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

TOTAL NUMBER OF MODELED POLLUTANTS = 20

NUMBER OF CARCINOGENIC POLLUTANTS = 11

1 10 13 20 22 36 70 83 111 130
137

NUMBER OF MULTIPATHWAY POLLUTANTS = 7

10 22 36 83 87 110 130

NUMBER OF POLLUTANTS WITH ACUTE NON-CANCER RISK = 7

3 38 70 87 111 137 151

MAXIMUM NUMBER OF ACUTE TOXICOLOGICAL ENDPOINTS = 3

NUMBER OF POLLUTANTS WITH CHRONIC NON-CANCER RISK = 17

1 3 10 13 22 36 38 70 83 85
87 110 111 137 145 151 152

MAXIMUM NUMBER OF CHRONIC TOXICOLOGICAL ENDPOINTS = 5

REQUIRED TOTAL ARRAY SIZE = 1088 WORDS

*** INPUT SOURCE EMISSION RATES ****

FOR SOURCE # 1 CSD
OPERATING HOURS = 8760.00 SURFACE AREA (m2) = 1.000E+00 DEPOSITION ADJUST. FACTOR = 1.00000

POLLUTANT NAME	POLLUTANT NUMBER	1-HOUR RATE (g/s)	1-HOUR RATE (lb/hr)	ANNUAL RATE (g/s)	ANNUAL RATE (lb/yr)
ACETA	1	0.000E+00	0.000E+00	8.300E-06	5.770E-01
ACROL	3	0.000E+00	0.000E+00	1.900E-06	1.321E-01
As	10	0.000E+00	0.000E+00	1.000E-05	6.952E-01
BENZE	13	0.000E+00	0.000E+00	1.400E-04	9.733E+00
BUTAD	20	0.000E+00	0.000E+00	7.100E-06	4.936E-01
Cd	22	0.000E+00	0.000E+00	1.600E-06	1.112E-01
Cr	36	0.000E+00	0.000E+00	2.600E-07	1.808E-02
Cu	38	0.000E+00	0.000E+00	4.700E-06	3.268E-01
HCHO	70	0.000E+00	0.000E+00	2.000E-05	1.390E+00
Pb	83	0.000E+00	0.000E+00	6.200E-06	4.310E-01
Mn	85	0.000E+00	0.000E+00	1.800E-06	1.251E-01
Hg	87	0.000E+00	0.000E+00	3.000E-06	2.086E-01
NAPTH	110	0.000E+00	0.000E+00	2.300E-05	1.599E+00
Ni	111	0.000E+00	0.000E+00	3.000E-06	2.086E-01
PAH	130	0.000E+00	0.000E+00	3.800E-05	2.642E+00
PROPL	134	0.000E+00	0.000E+00	5.100E-04	3.546E+01
Se	137	0.000E+00	0.000E+00	1.200E-05	8.343E-01
TOL	145	0.000E+00	0.000E+00	5.200E-05	3.615E+00
XYLEN	151	0.000E+00	0.000E+00	3.500E-05	2.433E+00
Zn	152	0.000E+00	0.000E+00	1.900E-05	1.321E+00

FOR SOURCE # 2 HD
OPERATING HOURS = 8760.00 SURFACE AREA (m2) = 1.000E+00 DEPOSITION ADJUST. FACTOR = 1.00000

POLLUTANT NAME	POLLUTANT NUMBER	1-HOUR RATE (g/s)	1-HOUR RATE (lb/hr)	ANNUAL RATE (g/s)	ANNUAL RATE (lb/yr)
ACETA	1	5.400E-05	4.286E-04	2.300E-06	1.599E-01
ACROL	3	1.700E-05	1.349E-04	7.300E-07	5.075E-02
As	10	1.200E-04	9.524E-04	5.200E-06	3.615E-01
BENZE	13	1.700E-03	1.349E-02	7.200E-05	5.006E+00
BUTAD	20	8.400E-05	6.667E-04	3.600E-06	2.503E-01
Cd	22	1.900E-05	1.508E-04	8.000E-07	5.562E-02
Cr	36	3.100E-06	2.460E-05	1.300E-07	9.038E-03
Cu	38	5.600E-05	4.444E-04	2.400E-06	1.669E-01
HCHO	70	1.700E-04	1.349E-03	7.300E-06	5.075E-01
Pb	83	7.400E-05	5.873E-04	3.200E-06	2.225E-01

Mn	85	2.200E-05	1.746E-04	9.300E-07	6.466E-02
Hg	87	3.500E-05	2.778E-04	1.500E-06	1.043E-01
NAPTH	110	2.800E-04	2.222E-03	1.200E-05	8.343E-01
Ni	111	3.500E-05	2.778E-04	1.500E-06	1.043E-01
PAH	130	4.600E-04	3.651E-03	2.000E-05	1.390E+00
PROPL	134	6.000E-03	4.762E-02	2.600E-04	1.808E+01
Se	137	1.500E-04	1.190E-03	6.400E-06	4.450E-01
TOL	145	6.100E-04	4.841E-03	2.600E-05	1.808E+00
XYLEN	151	4.200E-04	3.333E-03	1.800E-05	1.251E+00
Zn	152	2.200E-04	1.746E-03	9.500E-06	6.605E-01

FOR SOURCE # 3 BP
OPERATING HOURS = 8760.00 SURFACE AREA (m2) = 1.000E+00 DEPOSITION ADJUST. FACTOR = 1.00000

POLLUTANT NAME	POLLUTANT NUMBER	1-HOUR RATE (g/s)	1-HOUR RATE (lb/hr)	ANNUAL RATE (g/s)	ANNUAL RATE (lb/yr)
ACETA	1	3.600E-05	2.857E-04	1.600E-06	1.112E-01
ACROL	3	1.100E-05	8.730E-05	4.900E-07	3.407E-02
As	10	8.000E-05	6.349E-04	3.400E-06	2.364E-01
BENZE	13	1.100E-03	8.730E-03	4.800E-05	3.337E+00
BUTAD	20	5.600E-05	4.444E-04	2.400E-06	1.669E-01
Cd	22	1.200E-05	9.524E-05	5.300E-07	3.685E-02
Cr	36	2.100E-06	1.667E-05	8.800E-08	6.118E-03
Cu	38	3.700E-05	2.937E-04	1.600E-06	1.112E-01
HCHO	70	1.100E-04	8.730E-04	4.900E-06	3.407E-01
Pb	83	4.900E-05	3.889E-04	2.100E-06	1.460E-01
Mn	85	1.400E-05	1.111E-04	6.200E-07	4.310E-02
Hg	87	2.400E-05	1.905E-04	1.000E-06	6.952E-02
NAPTH	110	1.900E-04	1.508E-03	8.000E-06	5.562E-01
Ni	111	2.400E-05	1.905E-04	1.000E-06	6.952E-02
PAH	130	3.100E-04	2.460E-03	1.300E-05	9.038E-01
PROPL	134	4.000E-03	3.175E-02	1.700E-04	1.182E+01
Se	137	9.900E-05	7.857E-04	4.200E-06	2.920E-01
TOL	145	4.000E-04	3.175E-03	1.700E-05	1.182E+00
XYLEN	151	2.800E-04	2.222E-03	1.200E-05	8.343E-01
Zn	152	1.500E-04	1.190E-03	6.300E-06	4.380E-01

*** INPUT FACILITY-WIDE EMISSION RATES ***

POLLUTANT NAME	POLLUTANT NUMBER	1-HOUR RATE (g/s)	1-HOUR RATE (lb/hr)	ANNUAL RATE (g/s)	ANNUAL RATE (lb/yr)
ACETA	1	9.000E-05	7.143E-04	1.220E-05	8.482E-01
ACROL	3	2.800E-05	2.222E-04	3.120E-06	2.169E-01
As	10	2.000E-04	1.587E-03	1.860E-05	1.293E+00
BENZE	13	2.800E-03	2.222E-02	2.600E-04	1.808E+01
BUTAD	20	1.400E-04	1.111E-03	1.310E-05	9.108E-01
Cd	22	3.100E-05	2.460E-04	2.930E-06	2.037E-01
Cr	36	5.200E-06	4.127E-05	4.780E-07	3.323E-02
Cu	38	9.300E-05	7.381E-04	8.700E-06	6.049E-01
HCHO	70	2.800E-04	2.222E-03	3.220E-05	2.239E+00
Pb	83	1.230E-04	9.762E-04	1.150E-05	7.995E-01
Mn	85	3.600E-05	2.857E-04	3.350E-06	2.329E-01
Hg	87	5.900E-05	4.683E-04	5.500E-06	3.824E-01
NAPTH	110	4.700E-04	3.730E-03	4.300E-05	2.990E+00
Ni	111	5.900E-05	4.683E-04	5.500E-06	3.824E-01
PAH	130	7.700E-04	6.111E-03	7.100E-05	4.936E+00
PROPL	134	1.000E-02	7.937E-02	9.400E-04	6.535E+01
Se	137	2.490E-04	1.976E-03	2.260E-05	1.571E+00
TOL	145	1.010E-03	8.016E-03	9.500E-05	6.605E+00
XYLEN	151	7.000E-04	5.556E-03	6.500E-05	4.519E+00
Zn	152	3.700E-04	2.937E-03	3.480E-05	2.419E+00

*** INPUT POLLUTANT BACKGROUND CONCENTRATIONS (ug/m3) ****

POLLUTANT NAME	POLLUTANT NUMBER	1-HOUR BACKG.	ANNUAL BACKG.
ACETA	1	0.000E+00	0.000E+00
ACROL	3	0.000E+00	0.000E+00
As	10	0.000E+00	0.000E+00
BENZE	13	0.000E+00	0.000E+00
BUTAD	20	0.000E+00	0.000E+00
Cd	22	0.000E+00	0.000E+00
Cr	36	0.000E+00	0.000E+00
Cu	38	0.000E+00	0.000E+00
HCHO	70	0.000E+00	0.000E+00
Pb	83	0.000E+00	0.000E+00
Mn	85	0.000E+00	0.000E+00
Hg	87	0.000E+00	0.000E+00
NAPTH	110	0.000E+00	0.000E+00
Ni	111	0.000E+00	0.000E+00
PAH	130	0.000E+00	0.000E+00
PROPL	134	0.000E+00	0.000E+00
Se	137	0.000E+00	0.000E+00
TOL	145	0.000E+00	0.000E+00
XYLEN	151	0.000E+00	0.000E+00
Zn	152	0.000E+00	0.000E+00

*** INPUT RECEPTOR DATA ***

RECEPTOR #	RECEPTOR NAME	X-COORD	Y-COORD	ELEVATION	POPULATION	GARDEN FRAC	SCREEN X/Q
1	R74	481500.00	620500.00	10.00	1	0.00000	0.000E+00
2	MAXA	482200.00	618500.00	20.00	1	0.00000	0.000E+00

*** PATHWAY-SPECIFIC DATA ***

*** RISK LEVELS ***

Significant risk level		1.00E-06	
Zone of impact risk level		1.00E-07	
Significant hazard index for acute exposure		0.50	
Significant hazard index for chronic exposure		0.50	

*** INHALATION PATHWAY ***

Respiration rate (RR) (m3/d)		20.0	
Average body weight (ABW) (kg)		70.0	

*** MULTIPATHWAY POLLUTANTS ***

Number of multipathway pollutants		27	
Symbol and identification number	- Arsenic	As	10
	- Beryllium	Be	17
	- Cadmium	Cd	22
	- Chlorobenzene	CBZ	29
	- Chromium (hex.)	Cr	36
	- Dioxins/Dibenzofuran	TCDD	55
	- 2-Chlorophenol	CPHE2	33
	- p-Dichlorobenzene	PDCB	48
	- Hexachlorobenzene	HCB	74
	- Hexachlorocyclohexan	HCHEX	75
	- Lead	Pb	83
	- Mercury	Hg	87
	- NNitrosodiethylamine	NNETH	101
	- NNitrosodimethylamin	NNMET	102
	- NNitrosodiphenylamin	PNPHE	105
	- NNitrosodinbutylamin	NNBUT	103
	- NNitrosodinpropylami	NNDPP	104
	- NNitromethyethylamin	NNMEL	106
	- NNitrosomorpholine	NNMPH	107
	- NNitrosopiperidine	NNPRD	108
	- NNitrosopyrrolidine	NNPLD	109
	- Naphthalene	NAPTH	110
	- PAH	PAH	130
	- Polychlor. biphenyls	PCB	129
	- Pentachlorophenol	PENTA	155
	- 2,4,6Trichlorophenol	TC246	147
	- 2,4,5Trichlorophenol	TC245	157

*** SOIL ***

Vertical rate of deposition (Dep_rate) (m/s)	- Arsenic	0.02
	- Beryllium	0.02
	- Cadmium	0.02
	- Chlorobenzene	0.02
	- Chromium (hex.)	0.02
	- Dioxins/Dibenzofuran	0.02
	- 2-Chlorophenol	0.02
	- p-Dichlorobenzene	0.02

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                                            - Hexachlorobenzene     0.02
                                            - Hexachlorocyclohexan  0.02
                                            - Lead                  0.02
                                            - Mercury               0.02
                                            - NNitrosodiethylamine  0.02
                                            - NNitrosodimethylamin  0.02
                                            - NNitrosodiphenylamin  0.02
                                            - NNitrosodinbutylamin  0.02
                                            - NNitrosodinpropylami  0.02
                                            - NNitromethyethylamin  0.02
                                            - NNitrosomorpholine    0.02
                                            - NNitrosopiperidine    0.02
                                            - NNitrosopyrrolidine   0.02
                                            - Naphthalene           0.02
                                            - PAH                   0.02
                                            - Polychlor. biphenyls  0.02
                                            - Pentachlorophenol     0.02
                                            - 2,4,6Trichlorophenol  0.02
                                            - 2,4,5Trichlorophenol  0.02
    Beginning of evaluation period (To) (d)                         0.0
    End of evaluation period (Tf) (d)                               25550.0
    Soil mixing depth for human ingestion (SD) (m)                  0.0100
    Soil bulk density (BD) (kg/m3)                                  1333.0
    Chemical half-life in soil (t1/2)(d)    - Arsenic                 1.00E+08
                                            - Beryllium               1.00E+08
                                            - Cadmium                 1.00E+08
                                            - Chlorobenzene           1.50E+02
                                            - Chromium (hex.)         1.00E+08
                                            - Dioxins/Dibenzofuran    4.38E+03
                                            - 2-Chlorophenol          7.00E+01
                                            - p-Dichlorobenzene       1.80E+02
                                            - Hexachlorobenzene       2.09E+03
                                            - Hexachlorocyclohexan    1.70E+02
                                            - Lead                    1.00E+08
                                            - Mercury                 1.00E+08
                                            - NNitrosodiethylamine    1.80E+02
                                            - NNitrosodimethylamin    1.80E+02
                                            - NNitrosodiphenylamin    1.80E+02
                                            - NNitrosodinbutylamin    1.80E+02
                                            - NNitrosodinpropylami    1.80E+02
                                            - NNitromethyethylamin    1.80E+02
                                            - NNitrosomorpholine      1.80E+02
                                            - NNitrosopiperidine      1.80E+02
                                            - NNitrosopyrrolidine     1.80E+02
                                            - Naphthalene             4.80E+02
                                            - PAH                     4.80E+02
                                            - Polychlor. biphenyls    3.60E+03
                                            - Pentachlorophenol       1.78E+02
                                            - 2,4,6Trichlorophenol    7.00E+01
                                            - 2,4,5Trichlorophenol    6.90E+02
         *** WATER ***
    Location (receptor #) of drinking water source                      -1
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Site-specific water surface area (SA) (m2)		-1.0
Site-specific water volume (WV) (kg)		-1.0
Site-specific number of volume changes per year (VC)		-1.0
Site-specific fraction of run-off water (ROf)		-1.0
Wash coefficient-fraction of material washed by runoff (WC)		-1.0
Site-specific watershed area impacted (WSIA) (m2)		-1.0
Site-specific average annual rainfall (RF) (m)		-1.0
Site-specific watershed run-off coefficient (ROC)		-1.0
*** VEGETATION ***		
Location (receptor #) of crop source		0
Soil mixing depth (SD) for homegrown crops (m)		0.150
Interception coefficient for root crops (IFC_ROOT)		0.0
Interception coefficient for leafy crops (IFC_LEAFY)		0.20
Interception coefficient for vine crops (IFC_VINE)		0.10
Weathering constant (k) (1/d)		0.0495
Crop yield (Y) (kg/m2)		2.0
Crop growth period (T) (d)		90.0
Root uptake (UF2) - ROOT	- Arsenic	2.00E-03
	- Beryllium	4.00E-04
	- Cadmium	4.00E-02
	- Chlorobenzene	-1.0
	- Chromium (hex.)	1.00E-03
	- Dioxins/Dibenzofuran	-1.0
	- 2-Chlorophenol	-1.0
	- p-Dichlorobenzene	-1.0
	- Hexachlorobenzene	-1.0
	- Hexachlorocyclohexan	-1.0
	- Lead	2.00E-03
	- Mercury	2.00E-02
	- NNitrosodiethylamine	-1.0
	- NNitrosodimethylamin	-1.0
	- NNitrosodiphenylamin	-1.0
	- NNitrosodinbutylamin	-1.0
	- NNitrosodinpropylami	-1.0
	- NNitromethyethylamin	-1.0
	- NNitrosomorpholine	-1.0
	- NNitrosopiperidine	-1.0
	- NNitrosopyrrolidine	-1.0
	- Naphthalene	-1.0
	- PAH	-1.0
	- Polychlor. biphenyls	-1.0
	- Pentachlorophenol	-1.0
	- 2,4,6Trichlorophenol	-1.0
	- 2,4,5Trichlorophenol	-1.0
Root uptake (UF2) - LEAF	- Arsenic	4.00E-03
	- Beryllium	1.00E-03
	- Cadmium	6.00E-02
	- Chlorobenzene	-1.0
	- Chromium (hex.)	8.00E-04
	- Dioxins/Dibenzofuran	-1.0
	- 2-Chlorophenol	-1.0
	- p-Dichlorobenzene	-1.0

	- Hexachlorobenzene	-1.0
	- Hexachlorocyclohexan	-1.0
	- Lead	5.00E-03
	- Mercury	9.00E-02
	- NNitrosodiethylamine	-1.0
	- NNitrosodimethylamin	-1.0
	- NNitrosodiphenylamin	-1.0
	- NNitrosodinbutylamin	-1.0
	- NNitrosodinpropylami	-1.0
	- NNitromethyethylamin	-1.0
	- NNitrosomorpholine	-1.0
	- NNitrosopiperidine	-1.0
	- NNitrosopyrrolidine	-1.0
	- Naphthalene	-1.0
	- PAH	-1.0
	- Polychlor. biphenyls	-1.0
	- Pentachlorophenol	-1.0
	- 2,4,6Trichlorophenol	-1.0
	- 2,4,5Trichlorophenol	-1.0
Root uptake (UF2) - VINE	- Arsenic	9.00E-04
	- Beryllium	2.00E-04
	- Cadmium	2.00E-02
	- Chlorobenzene	-1.0
	- Chromium (hex.)	6.00E-04
	- Dioxins/Dibenzofuran	-1.0
	- 2-Chlorophenol	-1.0
	- p-Dichlorobenzene	-1.0
	- Hexachlorobenzene	-1.0
	- Hexachlorocyclohexan	-1.0
	- Lead	1.00E-03
	- Mercury	3.00E-02
	- NNitrosodiethylamine	-1.0
	- NNitrosodimethylamin	-1.0
	- NNitrosodiphenylamin	-1.0
	- NNitrosodinbutylamin	-1.0
	- NNitrosodinpropylami	-1.0
	- NNitromethyethylamin	-1.0
	- NNitrosomorpholine	-1.0
	- NNitrosopiperidine	-1.0
	- NNitrosopyrrolidine	-1.0
	- Naphthalene	-1.0
	- PAH	-1.0
	- Polychlor. biphenyls	-1.0
	- Pentachlorophenol	-1.0
	- 2,4,6Trichlorophenol	-1.0
	- 2,4,5Trichlorophenol	-1.0
Octanol:water partition factor (Kow)	- Arsenic	-1.0
	- Beryllium	-1.0
	- Cadmium	-1.0
	- Chlorobenzene	-1.0
	- Chromium (hex.)	-1.0
	- Dioxins/Dibenzofuran	-1.0

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                                       - 2-Chlorophenol         -1.0
                                       - p-Dichlorobenzene      -1.0
                                       - Hexachlorobenzene      -1.0
                                       - Hexachlorocyclohexan   -1.0
                                       - Lead                   -1.0
                                       - Mercury                -1.0
                                       - NNitrosodiethylamine   -1.0
                                       - NNitrosodimethylamin   -1.0
                                       - NNitrosodiphenylamin   -1.0
                                       - NNitrosodinbutylamin   -1.0
                                       - NNitrosodinpropylami   -1.0
                                       - NNitromethyethylamin   -1.0
                                       - NNitrosomorpholine     -1.0
                                       - NNitrosopiperidine     -1.0
                                       - NNitrosopyrrolidine    -1.0
                                       - Naphthalene            -1.0
                                       - PAH                    -1.0
                                       - Polychlor. biphenyls   -1.0
                                       - Pentachlorophenol      -1.0
                                       - 2,4,6Trichlorophenol   -1.0
                                       - 2,4,5Trichlorophenol   -1.0
   Organic carbon partition coeff (Koc) - Arsenic               -1.0
                                       - Beryllium              -1.0
                                       - Cadmium                -1.0
                                       - Chlorobenzene          -1.0
                                       - Chromium (hex.)        -1.0
                                       - Dioxins/Dibenzofuran   -1.0
                                       - 2-Chlorophenol         -1.0
                                       - p-Dichlorobenzene      -1.0
                                       - Hexachlorobenzene      -1.0
                                       - Hexachlorocyclohexan   -1.0
                                       - Lead                   -1.0
                                       - Mercury                -1.0
                                       - NNitrosodiethylamine   -1.0
                                       - NNitrosodimethylamin   -1.0
                                       - NNitrosodiphenylamin   -1.0
                                       - NNitrosodinbutylamin   -1.0
                                       - NNitrosodinpropylami   -1.0
                                       - NNitromethyethylamin   -1.0
                                       - NNitrosomorpholine     -1.0
                                       - NNitrosopiperidine     -1.0
                                       - NNitrosopyrrolidine    -1.0
                                       - Naphthalene            -1.0
                                       - PAH                    -1.0
                                       - Polychlor. biphenyls   -1.0
                                       - Pentachlorophenol      -1.0
                                       - 2,4,6Trichlorophenol   -1.0
                                       - 2,4,5Trichlorophenol   -1.0
   Fraction of organic in soil (Foc)                            0.10
        *** ANIMAL PRODUCTS ***
   Location (receptor #) of animal farm                           -1
   Soil mixing depth (SD) for animal pasture (m)               0.010
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Soil mixing depth (SD) for animal feed (m)		0.150
Inhalation rate (RR) (m3/d)	- Cattle/Lactating	8.00E+01
	- Pigs	7.00E+00
	- Poultry	1.00E+00
	- Goats/Sheep	6.00E+00
Water ingestion rate (WI) (kg/d)	- Cattle/Lactating	1.00E+02
	- Pigs	8.00E+00
	- Poultry	6.00E-01
	- Goats/Sheep	6.00E+00
Site-specific % water ingested from contaminated water (%SW)		0.25
Site-specific % diet provided by grazing (%G)		0.50
Site-specific % feed other than pasture locally grown (L)		1.00
Feed ingestion rate (FI) (kg/d)	- Cattle	8.00E+00
	- Lactating	1.60E+01
	- Pigs	2.00E+00
	- Poultry	3.00E-01
	- Goats/Sheep	2.00E+00
Soil ingested as % of feed ingested (%Sf)	- Cattle/Lactating	1.00E-02
	- Pigs	1.00E-02
	- Poultry	1.00E-02
	- Goats/Sheep	1.00E-02
Soil ingested as % of pasture ingested (%Sp)	- Cattle/Lactating	5.00E-02
	- Pigs	3.00E-02
	- Poultry	3.00E-02
	- Goats/Sheep	7.00E-02
Transfer coefficient of contaminant from diet to meat product (Fi_meat)	- Arsenic	2.00E-03
	- Beryllium	1.00E-03
	- Cadmium	3.50E-04
	- Chlorobenzene	-1.0
	- Chromium (hex.)	9.20E-03
	- Dioxins/Dibenzofuran	4.00E-01
	- 2-Chlorophenol	-1.0
	- p-Dichlorobenzene	-1.0
	- Hexachlorobenzene	-1.0
	- Hexachlorocyclohexan	-1.0
	- Lead	4.00E-04
	- Mercury	2.70E-02
	- NNitrosodiethylamine	-1.0
	- NNitrosodimethylamin	-1.0
	- NNitrosodiphenylamin	-1.0
	- NNitrosodinbutylamin	-1.0
	- NNitrosodinpropylami	-1.0
	- NNitromethyethylamin	-1.0
	- NNitrosomorpholine	-1.0
	- NNitrosopiperidine	-1.0
	- NNitrosopyrrolidine	-1.0
	- Naphthalene	-1.0
	- PAH	-1.0
	- Polychlor. biphenyls	5.00E-02
	- Pentachlorophenol	-1.0
	- 2,4,6Trichlorophenol	9.00E-05
	- 2,4,5Trichlorophenol	-1.0

Transfer coefficient of contaminant from diet to milk product (Fi_milk)	- Arsenic	6.20E-05
	- Beryllium	9.10E-07
	- Cadmium	1.00E-03
	- Chlorobenzene	-1.0
	- Chromium (hex.)	1.00E-05
	- Dioxins/Dibenzofuran	4.00E-02
	- 2-Chlorophenol	-1.0
	- p-Dichlorobenzene	-1.0
	- Hexachlorobenzene	-1.0
	- Hexachlorocyclohexan	-1.0
	- Lead	2.60E-04
	- Mercury	9.70E-06
	- NNitrosodiethylamine	-1.0
	- NNitrosodimethylamin	-1.0
	- NNitrosodiphenylamin	-1.0
	- NNitrosodinbutylamin	-1.0
	- NNitrosodinpropylami	-1.0
	- NNitromethyethylamin	-1.0
	- NNitrosomorpholine	-1.0
	- NNitrosopiperidine	-1.0
	- NNitrosopyrrolidine	-1.0
	- Naphthalene	-1.0
	- PAH	-1.0
	- Polychlor. biphenyls	1.00E-02
	- Pentachlorophenol	-1.0
	- 2,4,6Trichlorophenol	4.20E-05
	- 2,4,5Trichlorophenol	-1.0
Transfer coefficient of contaminant from diet to egg product (Fi_egg)	- Arsenic	2.00E-03
	- Beryllium	1.00E-03
	- Cadmium	3.50E-04
	- Chlorobenzene	-1.0
	- Chromium (hex.)	9.20E-03
	- Dioxins/Dibenzofuran	4.00E-01
	- 2-Chlorophenol	-1.0
	- p-Dichlorobenzene	-1.0
	- Hexachlorobenzene	-1.0
	- Hexachlorocyclohexan	-1.0
	- Lead	4.00E-04
	- Mercury	2.70E-02
	- NNitrosodiethylamine	-1.0
	- NNitrosodimethylamin	-1.0
	- NNitrosodiphenylamin	-1.0
	- NNitrosodinbutylamin	-1.0
	- NNitrosodinpropylami	-1.0
	- NNitromethyethylamin	-1.0
	- NNitrosomorpholine	-1.0
	- NNitrosopiperidine	-1.0
	- NNitrosopyrrolidine	-1.0
	- Naphthalene	-1.0
	- PAH	-1.0
	- Polychlor. biphenyls	5.00E-02
	- Pentachlorophenol	-1.0

	- 2,4,6Trichlorophenol	9.00E-05
	- 2,4,5Trichlorophenol	-1.0
Location (receptor #) of animal's water source		-1
Site-specific water surface area (SA) (m2)		1000.0
Site-specific water volume (WV) (kg)		2.00E+06
Site-specific number of volume changes per year (VC)		5.0
Site-specific fraction of run-off water (ROf)		-1.0
Wash coefficient-fraction of material washed by runoff (WC)		-1.0
Site-specific watershed area impacted (WSIA) (m2)		-1.0
Site-specific average annual rainfall (RF) (m)		-1.0
Site-specific watershed run-off coefficient (ROC)		-1.0
*** FISH PRODUCTS ***		
Location (receptor #) of fish farm/pond/lake/stream		-1
Site-specific water surface area (SA) (m2)		1.50E+05
Site-specific water volume (WV) (kg)		3.00E+08
Site-specific number of volume changes per year (VC)		5000.0
Site-specific fraction of run-off water (ROf)		-1.0
Wash coefficient-fraction of material washed by runoff (WC)		-1.0
Site-specific watershed area impacted (WSIA) (m2)		-1.0
Site-specific average annual rainfall (RF) (m)		-1.0
Site-specific watershed run-off coefficient (ROC)		-1.0
Bioconcentration factor (BCF)	- Arsenic	4.00E+00
	- Beryllium	1.90E+01
	- Cadmium	1.00E+02
	- Chlorobenzene	-1.0
	- Chromium (hex.)	2.00E+00
	- Dioxins/Dibenzofuran	5.00E+03
	- 2-Chlorophenol	-1.0
	- p-Dichlorobenzene	-1.0
	- Hexachlorobenzene	8.00E+03
	- Hexachlorocyclohexan	-1.0
	- Lead	1.55E+02
	- Mercury	5.00E+03
	- NNitrosodiethylamine	-1.0
	- NNitrosodimethylamin	-1.0
	- NNitrosodiphenylamin	-1.0
	- NNitrosodinbutylamin	-1.0
	- NNitrosodinpropylami	-1.0
	- NNitromethyethylamin	-1.0
	- NNitrosomorpholine	-1.0
	- NNitrosopiperidine	-1.0
	- NNitrosopyrrolidine	-1.0
	- Naphthalene	1.55E+03
	- PAH	1.55E+03
	- Polychlor. biphenyls	1.00E+05
	- Pentachlorophenol	-1.0
	- 2,4,6Trichlorophenol	5.00E+02
	- 2,4,5Trichlorophenol	-1.0
*** DERMAL ABSORPTION PATHWAY ***		
Surface area of exposed skin (SA) (cm2)		4656.0
Soil loading on skin (SL)		0.50
Fraction absorbed across skin (ABS)	- Arsenic	1.00E-03

	- Beryllium	1.00E-03
	- Cadmium	2.00E-03
	- Chlorobenzene	1.00E-01
	- Chromium (hex.)	1.00E-02
	- Dioxins/Dibenzofuran	2.00E-02
	- 2-Chlorophenol	1.00E-01
	- p-Dichlorobenzene	1.00E-01
	- Hexachlorobenzene	1.00E-01
	- Hexachlorocyclohexan	1.00E-01
	- Lead	1.00E-03
	- Mercury	1.00E-02
	- NNitrosodiethylamine	1.00E-01
	- NNitrosodimethylamin	1.00E-01
	- NNitrosodiphenylamin	1.00E-01
	- NNitrosodinbutylamin	1.00E-01
	- NNitrosodinpropylami	1.00E-01
	- NNitromethyethylamin	1.00E-01
	- NNitrosomorpholine	1.00E-01
	- NNitrosopiperidine	1.00E-01
	- NNitrosopyrrolidine	1.00E-01
	- Naphthalene	3.00E-02
	- PAH	3.00E-02
	- Polychlor. biphenyls	1.50E-01
	- Pentachlorophenol	1.00E-01
	- 2,4,6Trichlorophenol	1.00E-01
	- 2,4,5Trichlorophenol	1.00E-01

*** SOIL INGESTION PATHWAY ***

Lifetime average soil ingestion rate per day (Is) (mg/d) 110.0

Gastrointestinal absorption factor	- Arsenic	1.00E+00
(GI)	- Beryllium	1.00E+00
	- Cadmium	1.00E+00
	- Chlorobenzene	1.00E+00
	- Chromium (hex.)	1.00E+00
	- Dioxins/Dibenzofuran	1.00E+00
	- 2-Chlorophenol	1.00E+00
	- p-Dichlorobenzene	1.00E+00
	- Hexachlorobenzene	1.00E+00
	- Hexachlorocyclohexan	1.00E+00
	- Lead	1.00E+00
	- Mercury	1.00E+00
	- NNitrosodiethylamine	1.00E+00
	- NNitrosodimethylamin	1.00E+00
	- NNitrosodiphenylamin	1.00E+00
	- NNitrosodinbutylamin	1.00E+00
	- NNitrosodinpropylami	1.00E+00
	- NNitromethyethylamin	1.00E+00
	- NNitrosomorpholine	1.00E+00
	- NNitrosopiperidine	1.00E+00
	- NNitrosopyrrolidine	1.00E+00
	- Naphthalene	1.00E+00
	- PAH	1.00E+00
	- Polychlor. biphenyls	1.00E+00

	- Pentachlorophenol	1.00E+00
	- 2,4,6Trichlorophenol	1.00E+00
	- 2,4,5Trichlorophenol	1.00E+00
Bioavailability factors (BIO)	- Arsenic	1.0
	- Beryllium	1.0
	- Cadmium	1.0
	- Chlorobenzene	1.0
	- Chromium (hex.)	1.0
	- Dioxins/Dibenzofuran	4.30E-01
	- 2-Chlorophenol	1.0
	- p-Dichlorobenzene	1.0
	- Hexachlorobenzene	1.0
	- Hexachlorocyclohexan	1.0
	- Lead	1.0
	- Mercury	1.0
	- NNitrosodiethylamine	1.0
	- NNitrosodimethylamin	1.0
	- NNitrosodiphenylamin	1.0
	- NNitrosodinbutylamin	1.0
	- NNitrosodinpropylami	1.0
	- NNitromethyethylamin	1.0
	- NNitrosomorpholine	1.0
	- NNitrosopiperidine	1.0
	- NNitrosopyrrolidine	1.0
	- Naphthalene	1.0
	- PAH	1.0
	- Polychlor. biphenyls	1.0
	- Pentachlorophenol	1.0
	- 2,4,6Trichlorophenol	1.0
	- 2,4,5Trichlorophenol	1.0

*** WATER INGESTION PATHWAY ***

Lifetime average water ingestion rate per day (Iw) (l/d)	2.0

*** FOOD INGESTION - PLANT PRODUCTS PATHWAY ***

Site-specific fraction of root vegetable homegrown (L_Ir)	0.150
Site-specific fraction of leafy veget homegrown (L_leafy)	0.150
Site-specific fraction of vine veget homegrown (L_vine)	0.150
Daily consumption rate of root vegetable (IF_Ir) (kg/d)	0.050
Daily consumption rate of leafy veget (IF_leafy) (kg/d)	0.010
Daily consumption rate of vine veget (IF_vine) (kg/d)	0.250

*** FOOD INGESTION - ANIMAL PRODUCTS PATHWAY ***

Site-specific fraction of milk locally produced (L_Im)	0.00
Site-specific fraction of milk from cows	0.00
Site-specific fraction of milk from goats	0.00
Site-specific fraction of meat locally produced (L_Ib)	0.50
Site-specific fraction of meat from cows	0.50
Site-specific fraction of meat from pigs	0.00
Site-specific fraction of meat from poultry	0.50
Site-specific fraction of meat from goats/sheep	0.00
Site-specific fraction of eggs locally produced	1.00
Site-specific fraction of fish locally produced (L_Ifi)	0.00
Daily consumption rate of milk (IF_Im) (kg/d)	0.30
Daily consumption rate of meat (IF_Ib) (kg/d)	0.10

Daily consumption rate of egg (kg/d)		0.05
Daily consumption rate of fish (IF_Ifi) (kg/d)		0.023
*** MOTHER'S MILK PATHWAY ***		
Beginning of exposure period for mother (d)		0.0
End of exposure period for mother (d)		9490.0
Daily breast-milk ingestion rate (DERm) (kg/d)		0.90
Frequency of exposure (F) (d)		365.0
Period of exposure (YR) (yr)		1.00
Infant average body weight (ABS) (kg)		6.50
Fraction of contaminant partitioned to mother's fat (f1)		0.90
Percent fat of mother's milk (f3)		0.040
Percent mother's weight that is fat (f2)		0.330
Contaminant half-life in mother	- Arsenic	-1.0
(t1/2) (d)	- Beryllium	-1.0
	- Cadmium	-1.0
	- Chlorobenzene	-1.0
	- Chromium (hex.)	-1.0
	- Dioxins/Dibenzofuran	2117.00
	- 2-Chlorophenol	-1.0
	- p-Dichlorobenzene	-1.0
	- Hexachlorobenzene	-1.0
	- Hexachlorocyclohexan	-1.0
	- Lead	-1.0
	- Mercury	-1.0
	- NNitrosodiethylamine	-1.0
	- NNitrosodimethylamin	-1.0
	- NNitrosodiphenylamin	-1.0
	- NNitrosodinbutylamin	-1.0
	- NNitrosodinpropylami	-1.0
	- NNitromethyethylamin	-1.0
	- NNitrosomorpholine	-1.0
	- NNitrosopiperidine	-1.0
	- NNitrosopyrrolidine	-1.0
	- Naphthalene	-1.0
	- PAH	1460.0
	- Polychlor. biphenyls	1460.0
	- Pentachlorophenol	-1.0
	- 2,4,6Trichlorophenol	-1.0
	- 2,4,5Trichlorophenol	-1.0

*** PREDICTED PEAK 1-HOUR CONCENTRATIONS (ug/m3) FROM ALL SOURCES ***

RECEPTOR	ACETA	ACROL	As	BENZE	BUTAD	Cd	Cr	Cu	HCHO	Pb
1	1.276E-02	4.017E-03	2.835E-02	4.017E-01	1.985E-02	4.489E-03	7.324E-04	1.323E-02	4.017E-02	1.748E-02
2	1.362E-02	4.288E-03	3.027E-02	4.288E-01	2.119E-02	4.792E-03	7.819E-04	1.412E-02	4.288E-02	1.866E-02

ABOVE CONCENTRATIONS DO NOT INCLUDE THE FOLLOWING BACKGROUND CONCENTRATIONS:

0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

*** PREDICTED PEAK 1-HOUR CONCENTRATIONS (ug/m3) FROM ALL SOURCES ***

RECEPTOR	Mn	Hg	NAPTH	Ni	PAH	PROPL	Se	TOL	XYLEN	Zn
1	5.198E-03	8.270E-03	6.616E-02	8.270E-03	1.087E-01	1.418E+00	3.544E-02	1.441E-01	9.923E-02	5.198E-02
2	5.549E-03	8.827E-03	7.062E-02	8.827E-03	1.160E-01	1.513E+00	3.783E-02	1.538E-01	1.059E-01	5.549E-02

ABOVE CONCENTRATIONS DO NOT INCLUDE THE FOLLOWING BACKGROUND CONCENTRATIONS:

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

*** PREDICTED ANNUAL CONCENTRATIONS (ug/m3) FROM ALL SOURCES ***

RECEPTOR	ACETA	ACROL	As	BENZE	BUTAD	Cd	Cr	Cu	HCHO	Pb
1	3.603E-06	9.381E-07	5.693E-06	7.928E-05	3.992E-06	8.932E-07	1.452E-07	2.652E-06	9.661E-06	3.517E-06
2	3.403E-05	8.353E-06	4.773E-05	6.660E-04	3.363E-05	7.548E-06	1.227E-06	2.231E-05	8.686E-05	2.952E-05

ABOVE CONCENTRATIONS DO NOT INCLUDE THE FOLLOWING BACKGROUND CONCENTRATIONS:

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

*** PREDICTED ANNUAL CONCENTRATIONS (ug/m3) FROM ALL SOURCES ***

RECEPTOR	Mn	Hg	NAPTH	Ni	PAH	PROPL	Se	TOL	XYLEN	Zn
1	1.022E-06	1.675E-06	1.312E-05	1.675E-06	2.177E-05	2.875E-04	6.921E-06	2.902E-05	1.982E-05	1.061E-05
2	8.575E-06	1.415E-05	1.099E-04	1.415E-05	1.820E-04	2.420E-03	5.772E-05	2.453E-04	1.665E-04	8.963E-05

ABOVE CONCENTRATIONS DO NOT INCLUDE THE FOLLOWING BACKGROUND CONCENTRATIONS:

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**** RECEPTOR TOTAL CANCER RISK AND EXCESS BURDEN ***

RECEPTOR	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM	POPULATION	BURDEN
1	7.154E-08	2.333E-08	6.120E-08	0.000E+00	2.713E-07	0.000E+00	0.000E+00	4.273E-07	1	1.561E-07
2	6.009E-07	1.951E-07	5.123E-07	0.000E+00	2.269E-06	0.000E+00	0.000E+00	3.577E-06	1	1.308E-06

RECEPTOR # 2 HAS MAXIMUM PEAK RISK OF 3.577E-06
PEAK RECEPTOR LOCATED AT (X, Y) = 482200.000 618500.000
RECEPTOR POPULATION = 1
RECEPTOR BURDEN = 1.308E-06

TOTAL CANCER EXCESS BURDEN FROM ALL RECEPTORS = 1.464E-06
BURDEN COMPUTED WITH ZONE OF IMPACT RISK LEVEL = 1.000E-07

*** 70-YEAR LIFETIME CANCER RISK BY SOURCE FOR PEAK RECEPTOR # 2 ***

SOURCE	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM
1	4.206E-07	1.357E-07	3.568E-07	0.000E+00	1.578E-06	0.000E+00	0.000E+00	2.491E-06
2	1.789E-07	5.898E-08	1.543E-07	0.000E+00	6.857E-07	0.000E+00	0.000E+00	1.078E-06
3	1.427E-09	4.634E-10	1.216E-09	0.000E+00	5.388E-09	0.000E+00	0.000E+00	8.494E-09
SUM	6.009E-07	1.951E-07	5.123E-07	0.000E+00	2.269E-06	0.000E+00	0.000E+00	3.577E-06

RECEPTOR RISK OF 3.577E-06 EXCEEDS SIGNIFICANT RISK LEVEL OF 1.000E-06

RECEPTOR RISK OF 3.577E-06 EXCEEDS IMPACT ZONE RISK LEVEL OF 1.000E-07
RECEPTOR POPULATION = 1
RECEPTOR BURDEN = 1.308E-06

*** 70-YEAR LIFETIME CANCER RISK BY POLLUTANT FOR PEAK RECEPTOR # 2 ***

POLLUTANT	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM
ACETA	9.187E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.187E-11
As	1.575E 07	4.468E-09	2.111E-07	0.000E+00	8.799E-08	0.000E+00	0.000E+00	4.611E-07
BENZE	1.931E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.931E-08
BUTAD	5.717E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.717E-09
Cd	3.170E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.170E-08
Cr	1.717E-07	2.837E-10	1.341E-09	0.000E+00	5.395E-10	0.000E+00	0.000E+00	1.739E-07
HCHO	5.212E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.212E-10
Pb	2.362E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.362E-09
Ni	3.680E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.680E-09
PAH	2.002E-07	1.904E-07	2.998E-07	0.000E+00	2.180E-06	0.000E+00	0.000E+00	2.871E 06
Se	8.080E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.080E-09
SUM	6.009E-07	1.951E-07	5.123E-07	0.000E+00	2.269E-06	0.000E+00	0.000E+00	3.577E-06

RECEPTOR RISK OF 3.577E-06 EXCEEDS SIGNIFICANT RISK LEVEL OF 1.000E-06

RECEPTOR RISK OF 3.577E-06 EXCEEDS IMPACT ZONE RISK LEVEL OF 1.000E-07
RECEPTOR POPULATION = 1
RECEPTOR BURDEN = 1.308E-06

*** 70-YEAR LIFETIME DOSE (mg/kg/d) BY POLLUTANT FOR PEAK RECEPTOR # 2 ***

POLLUTANT	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM
ACETA	9.721E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.721E-09
As	1.364E-08	2.628E-09	1.242E-07	0.000E+00	5.176E-08	0.000E+00	0.000E+00	1.922E-07
BENZE	1.903E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.903E-07
BUTAD	9.609E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.609E-09
Cd	2.156E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.156E-09
Cr	3.504E-10	6.755E-10	3.192E-09	0.000E+00	1.285E 09	0.000E+00	0.000E+00	5.502E-09
HCHO	2.482E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.482E-08
Pb	8.435E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.435E-09
Ni	4.043E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.043E-09
PAH	5.201E-08	1.586E-08	2.499E-08	0.000E+00	1.817E-07	0.000E+00	0.000E+00	2.745E-07
Se	1.649E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.649E-08

*** 44-YEAR LIFETIME CANCER RISK BY SOURCE FOR PEAK RECEPTOR # 2 ***

SOURCE	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM
1	2.644E-07	8.838E-08	2.625E-07	0.000E+00	9.928E-07	0.000E+00	3.449E-07	1.953E-06
2	1.124E-07	3.841E-08	1.135E-07	0.000E+00	4.315E-07	0.000E+00	1.500E-07	8.458E-07
3	8.971E-10	3.018E-10	8.941E-10	0.000E+00	3.391E-09	0.000E+00	1.178E-09	6.662E-09
SUM	3.777E-07	1.271E-07	3.769E-07	0.000E+00	1.428E-06	0.000E+00	4.961E-07	2.805E-06

RECEPTOR RISK OF 2.805E-06 EXCEEDS SIGNIFICANT RISK LEVEL OF 1.000E-06

RECEPTOR RISK OF 2.805E-06 EXCEEDS IMPACT ZONE RISK LEVEL OF 1.000E-07

44-YEAR LIFETIME RISK OF 2.805E-06 IS LOWER THAN 70-YEAR LIFETIME RISK OF 3.577E-06

*** 44-YEAR LIFETIME CANCER RISK BY POLLUTANT FOR PEAK RECEPTOR # 2 ***

POLLUTANT	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM
ACETA	5.775E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.775E-11
As	9.900E-08	3.852E-09	1.820E-07	0.000E+00	5.694E-08	0.000E+00	0.000E+00	3.418E-07
BENZE	1.214E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.214E-08
BUTAD	3.594E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.594E-09
Cd	1.993E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.993E-08
Cr	1.079E-07	2.446E-10	1.156E-09	0.000E+00	3.451E-10	0.000E+00	0.000E+00	1.097E-07
HCHO	3.276E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.276E-10
Pb	1.485E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.485E-09
Ni	2.313E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.313E-09
PAH	1.259E-07	1.230E-07	1.937E-07	0.000E+00	1.370E-06	0.000E+00	4.961E-07	2.309E 06
Se	5.079E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.079E-09
SUM	3.777E 07	1.271E-07	3.769E-07	0.000E+00	1.428E-06	0.000E+00	4.961E-07	2.805E-06

RECEPTOR RISK OF 2.805E-06 EXCEEDS SIGNIFICANT RISK LEVEL OF 1.000E-06

RECEPTOR RISK OF 2.805E-06 EXCEEDS IMPACT ZONE RISK LEVEL OF 1.000E-07

44-YEAR LIFETIME RISK OF 2.805E-06 IS LOWER THAN 70-YEAR LIFETIME RISK OF 3.577E-06

*** 44-YEAR LIFETIME DOSE (mg/kg/d) BY POLLUTANT FOR PEAK RECEPTOR # 2 ***

POLLUTANT	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM
ACETA	9.721E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.721E 09
As	1.364E-08	3.605E-09	1.703E-07	0.000E+00	5.329E-08	0.000E+00	0.000E+00	2.409E-07
BENZE	1.903E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.903E-07
BUTAD	9.609E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.609E 09
Cd	2.156E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.156E-09
Cr	3.504E-10	9.264E-10	4.377E-09	0.000E+00	1.307E-09	0.000E+00	0.000E+00	6.961E-09
HCHO	2.482E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.482E 08
Pb	8.435E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.435E-09
Ni	4.043E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.043E-09
PAH	5.201E-08	1.631E-08	2.568E-08	0.000E+00	1.817E-07	0.000E+00	4.134E-08	3.170E-07
Se	1.649E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.649E-08

*** MAXIMUM ACUTE HAZARD INDEX BY POLLUTANT ***

POLLUTANT	PEAK CONC (ug/m3)	BACKGR (ug/m3)	TOTAL (ug/m3)	AEL (ug/m3)	HAZARD INDEX	RECEPTOR
ACROL	4.288E-03	0.000E+00	4.288E-03	2.500E+00	1.715E-03	2
Cu	1.412E-02	0.000E+00	1.412E-02	1.000E+01	1.412E-03	2
HCHO	4.288E-02	0.000E+00	4.288E-02	3.700E+02	1.159E-04	2
Hg	8.827E-03	0.000E+00	8.827E-03	3.000E+01	2.942E-04	2
Ni	8.827E-03	0.000E+00	8.827E-03	1.000E+00	8.827E-03	2
Se	3.783E-02	0.000E+00	3.783E-02	2.000E+00	1.892E-02	2
XYLEN	1.059E-01	0.000E+00	1.059E-01	4.400E+03	2.407E-05	2

*** RECEPTOR ACUTE HAZARD INDICES BY TOXICOLOGICAL ENDPOINTS ***

FROM ALL SOURCES AND POLLUTANTS

RECEPTOR	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
1	0.000E+00	2.757E-04	8.270E-03	2.757E-04	2.757E-04	0.000E+00	2.078E-02	0.000E+00
2	0.000E+00	2.942E-04	8.827E-03	2.942E-04	2.942E-04	0.000E+00	2.218E-02	0.000E+00

RECEPTOR # 2 HAS MAXIMUM ACUTE HAZARD INDEX OF 2.218E-02

*** ACUTE HAZARD INDEX BY POLLUTANT FOR PEAK RECEPTOR # 2 ***

POLLUTANT	CONC (ug/m3)	BACKGR (ug/m3)	AEL (ug/m3)	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
ACROL	4.288E-03	0.000E+00	2.500E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.715E-03	0.000E+00
Cu	1.412E-02	0.000E+00	1.000E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.412E-03	0.000E+00
HCHO	4.288E-02	0.000E+00	3.700E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.159E-04	0.000E+00
Hg	8.827E-03	0.000E+00	3.000E+01	0.000E+00	2.942E-04	0.000E+00	2.942E-04	2.942E-04	0.000E+00	0.000E+00	0.000E+00
Ni	8.827E-03	0.000E+00	1.000E+00	0.000E+00	0.000E+00	8.827E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Se	3.783E-02	0.000E+00	2.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.892E-02	0.000E+00
XYLEN	1.059E-01	0.000E+00	4.400E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.407E-05	0.000E+00
			SUM =	0.000E+00	2.942E-04	8.827E-03	2.942E-04	2.942E-04	0.000E+00	2.218E-02	0.000E+00

*** ACUTE HAZARD INDEX BY SOURCE FOR PEAK RECEPTOR # 2 ***

POLLUTANT ACROL AEL (ug/m3) = 2.500E+00 BACKGR. (ug/m3) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.715E-03	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.715E-03	0.000E+00

POLLUTANT Cu AEL (ug/m3) = 1.000E+01 BACKGR. (ug/m3) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.412E-03	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.412E-03	0.000E+00

POLLUTANT HCHO AEL (ug/m3) = 3.700E+02 BACKGR. (ug/m3) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.159E-04	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.159E-04	0.000E+00

POLLUTANT Hg AEL (ug/m3) = 3.000E+01 BACKGR. (ug/m3) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 2	0.000E+00	2.942E-04	0.000E+00	2.942E-04	2.942E-04	0.000E+00	0.000E+00	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
SUM =	0.000E+00	2.942E-04	0.000E+00	2.942E-04	2.942E-04	0.000E+00	0.000E+00	0.000E+00

POLLUTANT Ni AEL (ug/m3) = 1.000E+00 BACKGR. (ug/m3) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 2	0.000E+00	0.000E+00	8.827E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SUM =	0.000E+00	0.000E+00	8.827E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

POLLUTANT Se AEL (ug/m3) = 2.000E+00 BACKGR. (ug/m3) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.892E-02	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.892E-02	0.000E+00

POLLUTANT XYLEN AEL (ug/m3) = 4.400E+03 BACKGR. (ug/m3) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	EYE
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.407E-05	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.407E-05	0.000E+00

*** MAXIMUM CHRONIC EXPOSURE BY POLLUTANT FROM ALL SOURCES ***

POL.	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOT MILK	NON-INH DOSE SUM	ACCEPTABL ORAL DOSE	INH CONC (ug/m3)	BACKGR (ug/m3)	AEL (ug/m3)	HAZARD INDEX	REC.
	****************************PATHWAY DOSE (mg/kg-d)****************************													
ACETA	9.72E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.40E-05	0.00E+00	9.00E+00	3.78E-06	2
ACROL	2.39E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.35E-06	0.00E+00	2.00E-02	4.18E-04	2
As	1.36E-08	2.63E-09	1.24E-07	0.00E+00	5.18E-08	0.00E+00	0.00E+00	1.79E-07	1.00E-03	4.77E-05	0.00E+00	5.00E-01	2.74E-04	2
BENZE	1.90E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.66E-04	0.00E+00	7.10E+01	9.38E-06	2
Cd	2.16E-09	8.31E-10	1.96E-08	0.00E+00	2.11E-08	0.00E+00	0.00E+00	4.16E-08	1.00E-03	7.55E-06	0.00E+00	3.50E+00	4.37E-05	2
Cr	3.50E-10	6.75E-10	3.19E-09	0.00E+00	1.28E-09	0.00E+00	0.00E+00	5.15E-09	5.00E-03	1.23E-06	0.00E+00	2.00E-03	6.14E-04	2
Cu	6.37E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-05	0.00E+00	2.40E+00	9.30E-06	2
HCHO	2.48E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.69E-05	0.00E+00	3.60E+00	2.41E-05	2
Pb	8.44E-09	1.63E-09	7.68E-08	0.00E+00	3.23E-08	0.00E+00	0.00E+00	1.11E-07	4.30E-04	2.95E-05	0.00E+00	1.50E+00	2.77E-04	2
Mn	2.45E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.57E-06	0.00E+00	4.00E-01	2.14E-05	2
Hg	4.04E-09	7.79E-09	3.68E-08	0.00E+00	4.56E-08	0.00E+00	0.00E+00	9.02E-08	3.00E-04	1.42E-05	0.00E+00	3.00E-01	3.48E-04	2
NAPTH	3.14E-08	9.58E-09	1.51E-08	0.00E+00	1.10E-07	0.00E+00	0.00E+00	1.34E-07	4.00E-03	1.10E-04	0.00E+00	1.40E+01	4.14E-05	2
Ni	4.04E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-05	0.00E+00	2.40E-01	5.90E-05	2
Se	1.65E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.77E-05	0.00E+00	5.00E-01	1.15E-04	2
TOL	7.01E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-04	0.00E+00	2.00E+02	1.23E-06	2
XYLEN	4.76E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-04	0.00E+00	3.00E+02	5.55E-07	2
Zn	2.56E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.96E-05	0.00E+00	3.50E+01	2.56E-06	2

*** RECEPTOR CHRONIC HAZARD INDICES BY TOXICOLOGICAL ENDPOINTS ***
FROM ALL SOURCES AND POLLUTANTS

RECEPTOR	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
1	1.121E-04	1.107E-04	3.999E-05	1.591E-04	1.139E-04	3.322E-05	1.647E-04	3.269E-05
2	9.431E-04	9.311E-04	3.361E-04	1.342E-03	9.622E-04	2.789E-04	1.412E-03	2.740E-04

RECEPTOR # 2 HAS HIGHEST CHRONIC HAZARD INDEX OF 1.412E-03

*** CHRONIC HAZARD INDEX BY POLLUTANT FOR PEAK RECEPTOR # 2 ***

POLLUTANT	ORAL DOSE (mg/kg d)	BACKGR (ug/m3)	AEL (ug/m3)	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
ACETA	0.000E+00	0.000E+00	9.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.781E-06	0.000E+00
ACROL	0.000E+00	0.000E+00	2.000E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.176E-04	0.000E+00
As	1.000E-03	0.000E+00	5.000E-01	2.740E-04	2.740E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.545E-05	2.740E-04
BENZE	0.000E+00	0.000E+00	7.100E+01	0.000E+00	9.380E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cd	1.000E-03	0.000E+00	3.500E+00	0.000E+00	0.000E+00	0.000E+00	4.373E-05	0.000E+00	0.000E+00	2.156E-06	0.000E+00
Cr	5.000E-03	0.000E+00	2.000E-03	0.000E+00	0.000E+00	0.000E+00	6.143E-04	6.143E-04	0.000E+00	6.133E-04	0.000E+00
Cu	0.000E+00	0.000E+00	2.400E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.296E-06	0.000E+00
HCHO	0.000E+00	0.000E+00	3.600E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.413E-05	0.000E+00
Pb	4.300E-04	0.000E+00	1.500E+00	2.772E-04	2.772E-04	2.772E-04	2.772E-04	0.000E+00	2.772E-04	0.000E+00	0.000E+00
Mn	0.000E+00	0.000E+00	4.000E-01	0.000E+00	2.144E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.144E-05	0.000E+00
Hg	3.000E-04	0.000E+00	3.000E-01	3.479E-04	3.479E-04	0.000E+00	3.479E-04	3.479E-04	0.000E+00	4.717E-05	0.000E+00
NAPTH	4.000E-03	0.000E+00	1.400E+01	4.143E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ni	0.000E+00	0.000E+00	2.400E-01	0.000E+00	0.000E+00	5.897E-05	5.897E-05	0.000E+00	0.000E+00	5.897E-05	0.000E+00
Se	0.000E+00	0.000E+00	5.000E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.154E-04	0.000E+00
TOL	0.000E+00	0.000E+00	2.000E+02	0.000E+00	1.226E-06	0.000E+00	0.000E+00	0.000E+00	1.226E-06	0.000E+00	0.000E+00
XYLEN	0.000E+00	0.000E+00	3.000E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.550E-07	5.550E-07	0.000E+00
Zn	0.000E+00	0.000E+00	3.500E+01	2.561E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.561E-06	0.000E+00
			SUM =	9.431E-04	9.311E-04	3.361E-04	1.342E-03	9.622E-04	2.789E-04	1.412E-03	2.740E-04

*** CHRONIC HAZARD INDEX BY SOURCE FOR PEAK RECEPTOR # 2 ***

POLLUTANT ACETA ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 9.000E+00 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.071E-06	0.000E+00
SOURCE # 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.032E-07	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.912E-09	0.000E+00
SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.781E-06	0.000E+00

POLLUTANT ACROL ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 2.000E-02 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE # 1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.164E-04	0.000E+00
SOURCE # 2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.004E-04	0.000E+00
SOURCE # 3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.148E-07	0.000E+00
SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.176E-04	0.000E+00

POLLUTANT As ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 5.000E-01 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 1.000E-03

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE # 1	1.912E-04	1.912E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.661E-05	1.912E-04
SOURCE # 2	8.215E-05	8.215E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.862E-05	8.215E-05
SOURCE # 3	6.492E-07	6.492E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.261E-07	6.492E-07
SUM =	2.740E-04	2.740E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.545E-05	2.740E-04

POLLUTANT BENZE ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 7.100E+01 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

	CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE # 1	0.000E+00	6.567E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE # 2	0.000E+00	2.790E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	3	0.000E+00	2.248E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SUM =		0.000E+00	9.380E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

POLLUTANT Cd ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 3.500E+00 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 1.000E-03

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	0.000E+00	0.000E+00	3.088E-05	0.000E+00	0.000E+00	1.523E-06	0.000E+00
SOURCE #	2	0.000E+00	0.000E+00	0.000E+00	1.275E-05	0.000E+00	0.000E+00	6.289E-07	0.000E+00
SOURCE #	3	0.000E+00	0.000E+00	0.000E+00	1.021E-07	0.000E+00	0.000E+00	5.036E-09	0.000E+00
SUM =		0.000E+00	0.000E+00	0.000E+00	4.373E-05	0.000E+00	0.000E+00	2.156E-06	0.000E+00

POLLUTANT Cr ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 2.000E-03 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 5.000E-03

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	0.000E+00	0.000E+00	4.337E-04	4.337E-04	0.000E+00	4.330E-04	0.000E+00
SOURCE #	2	0.000E+00	0.000E+00	0.000E+00	1.792E-04	1.792E-04	0.000E+00	1.789E-04	0.000E+00
SOURCE #	3	0.000E+00	0.000E+00	0.000E+00	1.466E-06	1.466E-06	0.000E+00	1.463E-06	0.000E+00
SUM =		0.000E+00	0.000E+00	0.000E+00	6.143E-04	6.143E-04	0.000E+00	6.133E-04	0.000E+00

POLLUTANT Cu ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 2.400E+00 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.522E-06	0.000E+00
SOURCE #	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.752E-06	0.000E+00
SOURCE #	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.217E-08	0.000E+00
SUM =		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.296E-06	0.000E+00

POLLUTANT HCHO ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 3.600E+00 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.850E-05	0.000E+00
SOURCE #	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.580E-06	0.000E+00
SOURCE #	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.527E-08	0.000E+00
SUM =		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.413E-05	0.000E+00

POLLUTANT Pb ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 1.500E+00 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 4.300E-04

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	1.938E-04	1.938E-04	1.938E-04	1.938E-04	0.000E+00	1.938E-04	0.000E+00	0.000E+00
SOURCE #	2	8.266E-05	8.266E-05	8.266E-05	8.266E-05	0.000E+00	8.266E-05	0.000E+00	0.000E+00
SOURCE #	3	6.556E-07	6.556E-07	6.556E-07	6.556E-07	0.000E+00	6.556E-07	0.000E+00	0.000E+00
	SUM =	2.772E-04	2.772E-04	2.772E-04	2.772E-04	0.000E+00	2.772E-04	0.000E+00	0.000E+00

POLLUTANT Mn ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 4.000E-01 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	1.499E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.499E-05	0.000E+00
SOURCE #	2	0.000E+00	6.397E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.397E-06	0.000E+00
SOURCE #	3	0.000E+00	5.155E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.155E-08	0.000E+00
	SUM =	0.000E+00	2.144E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.144E-05	0.000E+00

POLLUTANT Hg ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 3.000E-01 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 3.000E-04

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	2.456E-04	2.456E-04	0.000E+00	2.456E-04	2.456E-04	0.000E+00	3.331E-05	0.000E+00
SOURCE #	2	1.015E-04	1.015E-04	0.000E+00	1.015E-04	1.015E-04	0.000E+00	1.376E-05	0.000E+00
SOURCE #	3	8.175E-07	8.175E-07	0.000E+00	8.175E-07	8.175E-07	0.000E+00	1.109E-07	0.000E+00
	SUM =	3.479E-04	3.479E-04	0.000E+00	3.479E-04	3.479E-04	0.000E+00	4.717E-05	0.000E+00

POLLUTANT NAPTH ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 1.400E+01 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 4.000E-03

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	2.888E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE #	2	1.245E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOURCE #	3	1.003E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	SUM =	4.143E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

POLLUTANT Ni ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 2.400E-01 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	0.000E+00	4.163E-05	4.163E-05	0.000E+00	0.000E+00	4.163E-05	0.000E+00
SOURCE #	2	0.000E+00	0.000E+00	1.720E-05	1.720E-05	0.000E+00	0.000E+00	1.720E-05	0.000E+00
SOURCE #	3	0.000E+00	0.000E+00	1.386E-07	1.386E-07	0.000E+00	0.000E+00	1.386E-07	0.000E+00
	SUM =	0.000E+00	0.000E+00	5.897E-05	5.897E-05	0.000E+00	0.000E+00	5.897E-05	0.000E+00

POLLUTANT Se ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 5.000E-01 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.993E-05	0.000E+00
SOURCE #	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.522E-05	0.000E+00
SOURCE #	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.794E-07	0.000E+00
	SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.154E-04	0.000E+00

POLLUTANT TOL ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 2.000E+02 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	8.659E-07	0.000E+00	0.000E+00	0.000E+00	8.659E-07	0.000E+00	0.000E+00
SOURCE #	2	0.000E+00	3.577E-07	0.000E+00	0.000E+00	0.000E+00	3.577E-07	0.000E+00	0.000E+00
SOURCE #	3	0.000E+00	2.827E-09	0.000E+00	0.000E+00	0.000E+00	2.827E-09	0.000E+00	0.000E+00
	SUM =	0.000E+00	1.226E-06	0.000E+00	0.000E+00	0.000E+00	1.226E-06	0.000E+00	0.000E+00

POLLUTANT XYLEN ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 3.000E+02 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.886E-07	3.886E-07	0.000E+00
SOURCE #	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.651E-07	1.651E-07	0.000E+00
SOURCE #	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.330E-09	1.330E-09	0.000E+00
	SUM =	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.550E-07	5.550E-07	0.000E+00

POLLUTANT Zn ACCEPTABLE EXPOSURE LEVEL (ug/m3) = 3.500E+01 BACKG. (ug/m3) = 0.000E+00 ORAL DOSE (mg/kg-d) = 0.000E+00

		CV	CNS	IMMUN	KIDN	LIVER	REPRO	RESP	SKIN
SOURCE #	1	1.808E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.808E-06	0.000E+00
SOURCE #	2	7.469E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.469E-07	0.000E+00
SOURCE #	3	5.986E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.986E-09	0.000E+00
	SUM =	2.561E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.561E-06	0.000E+00

*** SUMMARY OF MAXIMUM PREDICTED RISKS ***

CANCER RISK ASSESSMENT

```
SIGNIFICANT RISK LEVEL =     1.000E-06
IMPACT ZONE RISK LEVEL =     1.000E-07
MAXIMUM PEAK RISK =          3.577E-06
PREDICTED AT RECEPTOR #              2
TOTAL EXCESS BURDEN =        1.464E-06

    1 RECEPTORS WITH RISK EXCEEDING SIGNIFICANT RISK LEVEL OF    1.000E-06

        2
```

ACUTE EXPOSURE TO NON-CANCER POLLUTANTS

```
SIGNIFICANT HAZARD INDEX  =                 0.5000
MAXIMUM HAZARD INDEX FOR AN ENDPOINT =      0.0222
PREDICTED AT RECEPTOR #                          2

    0 RECEPTORS WITH HAZARD INDEX .GE.     0.5000 FOR ONE OR MORE TOXICOLOGICAL ENDPOINTS
```

CHRONIC EXPOSURE TO NON-CANCER POLLUTANTS

```
SIGNIFICANT HAZARD INDEX =                0.5000
MAXIMUM HAZARD INDEX FOR AN ENDPOINT =    0.0014
PREDICTED AT RECEPTOR #                        2

    0 RECEPTORS WITH HAZARD INDEX .GE.     0.5000 FOR ONE OR MORE TOXICOLOGICAL ENDPOINTS
```

*** END OF ACE2588 SIMULATION ***

SECTION 3.11

NASNI SUPPLEMENTAL NOISE INFORMATION

SECTION 3.11
NASNI NOISE SUPPLEMENTAL INFORMATION

In October 1998, the City of Coronado completed the "City of Coronado Noise Study – 1998" (RECON 1998). The purpose of the study was to provide an understanding of noise effects in the City of Coronado and to provide a legally adequate and defensible noise contour map for the *General Plan Noise Element*. The study considered noise produced from traffic, aircraft overflights, and stationary sources. The study includes an assessment of community effects of traffic noise along designated truck routes and specific consideration of the contribution of trucks and busses to those noise levels. The study addressed measures to reduce noise levels and made recommendations to minimize potential adverse effects on area residents.

A series of noise measurements were made as part of the study. The measurements were conducted using a calibrated Larson-Davis model 720 integrating sound level meter that meets the American National Standards Institute (ANSI) requirements for a type 2 meter. Measurements were taken for periods ranging in length from 1 hour to 2 weeks. One-hour noise measurements and associated traffic counts were made at 39 locations along roadways in the city. Twenty-four hour measurements were made at six locations, and 2-week measurements were made at two locations. In addition, measurements were taken during the morning and afternoon peak hour traffic periods along SR-75 and SR-282. The locations of the noise monitoring sites are shown on Figure 3.11-1.

The results of the 1-hour noise measurements are summarized in Table 3.11-1. The hourly Leq measurements range from 59.7 dBA to 78.2 dBA. Note that 30 of the 39 measurements exceed the *General Plan Noise Element* standard of 65 dBA.

The results of the 24-hour measurements are summarized in Table 3.11-2. The noise levels ranged from 59 dBA Leq to 72 dBA Leq and the measured CNEL ranged from 64 dBA at 2nd and Prospect to 75 dBA at locations adjacent to 3rd and 4th Streets. Again, most of the measurements equal or exceed the *General Plan Noise Element* standard of 65 dBA.

The results of the 2-week measurements are summarized in Table 3.11-3. The two locations were atop the 1720 Avenida del Mundo building at the Coronado Shores and atop the lifeguard tower adjacent to Ocean Boulevard. Noise levels for these locations were dominated by aircraft overflights. Both locations were close to the *General Plan Noise Element* standard of 65 dBA with the Coronado Shores location at 63.3 dBA Leq and the lifeguard tower location at 67.6 dBA Leq.

The results of the peak hour measurements are summarized in Table 3.11-4. The traffic counts were obtained from Caltrans. The noise levels ranged from 69.9 dBA Leq to 72 dBA Leq, all more than the *General Plan Noise Element* standard of 65 dBA.

The study used the noise measurement data along with San Diego Association of Governments traffic projections for the year 2015 to develop future noise contours for the circulation element roadways.

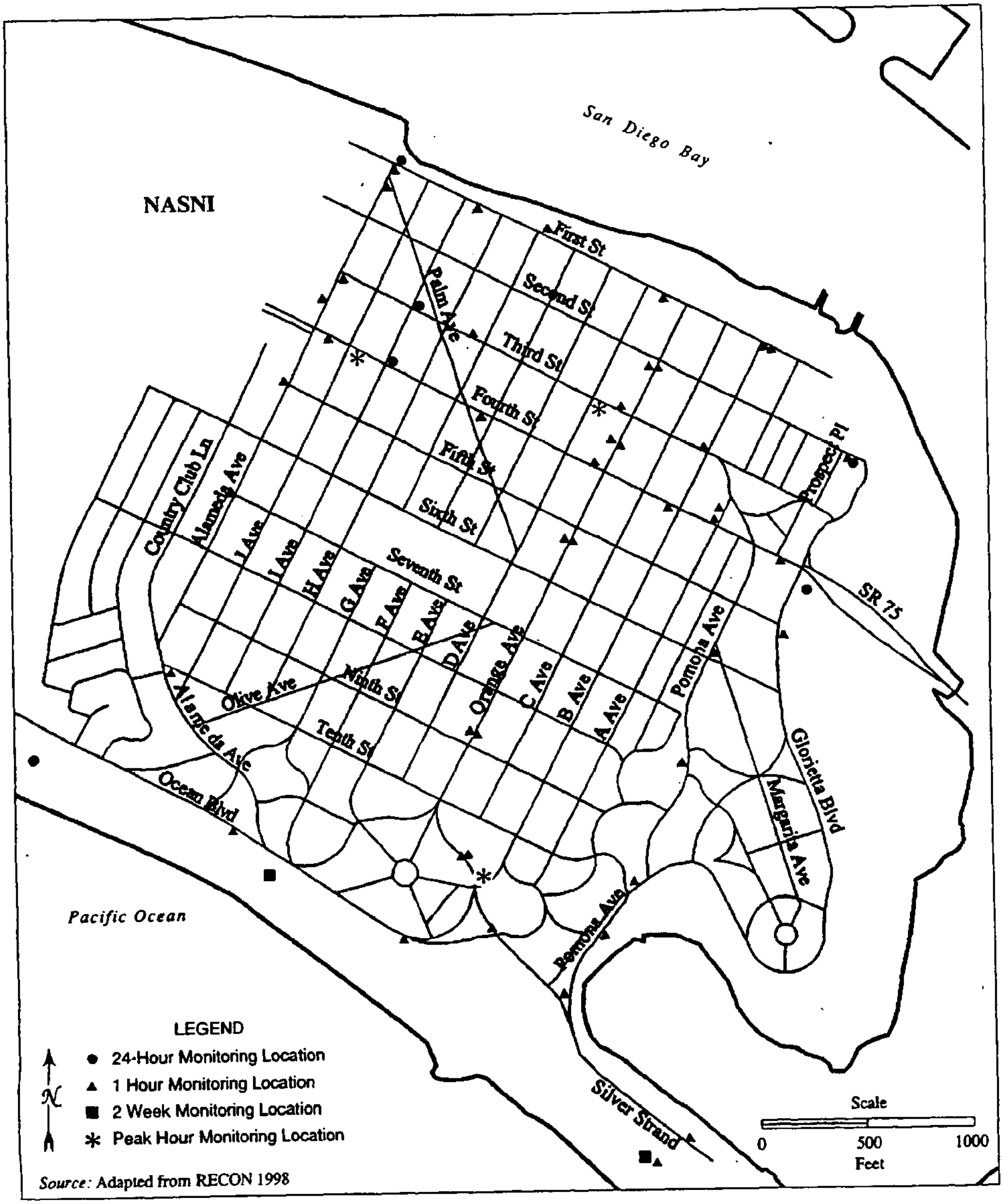


Figure 3.11-1. Noise Monitoring Locations

Table 3.11-1. Summary of One-Hour Interval Data

Roadway/Segment	*Hourly Leq*	*Vehicle Count*	*Start Time*	*Date*
First Street				
Alameda to J Avenue	67.4	335	9:25	28 May
Between H & I Avenues	65.2	372	10:33	28 May
Between F & G Avenues	66.5	380	15:44	30 Jul
Between Orange & D Avenues	66.2	411	13:02	28 May
Between A & B Avenues	62.4	306	14:19	28 May
Second Street at Soledad	59.7	323	9:19	9 Jun
Third Street				
Alameda	67.2	808	9:22	20 May
G Avenue	66.2	735	10.32	20 May
D Avenue	68.3	846	11:45	20 May
B Avenue	72.4	1,749	13:01	20 May
Fourth Street				
Alameda	69.1	654	9:26	21 May
Palm	66.5	943	10:36	21 May
Orange & D Avenues	67.3	908	11:47	21 May
B & C Avenues	71.9	2,089	13:31	21 May
A Avenue	76.9	3,431	14:45	21 May
SR-75 between Glorietta & Pomona	77.0	5,031	16:02	21 May
Alameda				
Palm	63.9	198	9:20	26 May
Between 3rd & 4th Streets	72.1	727	10:26	26 May
5th Street	65.1	598	11:59	26 May
7th Street	65.3	582	13:15	26 May
10th Street	66.0	426	17:17	26 May
Orange Avenue				
2nd Street	69.0	646	9:01	2 Jun
3rd & 4th Streets	72.4	1,422	10:30	2 Jun
5th & 6th Streets	74.9	1,870	11:47	2 Jun
9th Street	73.9	1,632	13:04	2 Jun
C Avenue	78.2	1,485	14:12	2 Jun
Adella	73.0	NC	12:31	9 Jun
Pomona				
Orange Avenue	67.8	561	11:37	9 Jun
Strand Way	69.2	671	12:49	9 Jun
10th Street	69.2	1,052	14:11	9 Jun
Parkview	62.1	782	15:32	9 Jun
6th Street	67.1	902	16:40	9 Jun
Glorietta at 5th Street	67.3	860	15:33	22 Jun
A Avenue at Pomona	63.1	249	8:58	24 Jun
Silver Strand Boulevard at Avenida de las Arenas	74.7	NC	15:27	2 Jun
Coronado Cays				
At corner of Cays Boulevard & Mardi Gras	62.9	61	11:06	9 Jun
Median	78.0	NC	11:02	9 Jun
Ocean				
Near Alameda	62.8	305	12:37	2 Jun
Churchill	63.2	792	14:00	2 Jun

NC = no count
Source: RECON 1998

Table 3.11-2. Summary of 24-Hour Measurements

Location	*Leq*	*Lmax*	*Lmin*	*CNEL*
1st Street and Alameda	65	100	47	68
4th Street and I Avenue	72	96	34	74
Glorietta and 4th Street	72	99	57	75
Ocean Boulevard	72	115	44	73
2nd Street and Prospect	59	88	45	64
3rd Street and I Avenue	69	98	35	75

Source: RECON 1998

Table 3.11-3. Summary of Two-Week Measurements

Location	*Start Date*	*End Date*	*Leq*	*Lmax*	*Lmin*
Lifeguard Tower	6/15/98	6/29/98	67.6	109.4	50.8
Coronado Shores	6/15/98	6/29/98	63.3	103.2	54.1

Source: RECON 1998

Table 3.11-4. Summary of Peak-Hour Measurements

Location	*Initial Time of Measurement*	*Leq*	*Lmax*	*Lmin*
3rd Street and D Avenue	6:45 A.M.	70.9	84.2	50.0
4th Street and I Avenue	3:21 P.M.	72.0	89.5	51.1
Orange Avenue and Churchill	4:20 P.M.	70.9	90.5	58.4
Orange Avenue and Churchill	7:53 A.M.	69.9	84.2	53.8

Source: RECON 1998

SECTION 3.15

NASNI SUPPLEMENTAL HEALTH AND SAFETY INFORMATION

SECTION 3.15
NASNI SUPPLEMENTAL HEALTH AND SAFETY INFORMATION

HAZARDOUS WASTE PROGRAM

The Navy Public Works Center (PWC), San Diego, Treatment Complex at Naval Air Station North Island (NASNI) includes an Industrial Waste Treatment Plant (IWTP) completed in 1994; an Oily Recovery Plant (ORP) completed in 1996; a Hazardous Materials and Waste Collection, Storage, and Transfer (CST2) Facility completed in 1996; and a Hazardous Materials and Waste Collection, Storage, and Transfer (CST) Facility, completed in 1979. These facilities are located in a contiguous area, approximately centered within the boundaries of NASNI. As part of its CST operation, PWC maintains one polychlorinated biphenyl (PCB) storage facility completed in 1981. The PCB storage facility is located inside the Sithe Energies, Inc. cogeneration plant at NASNI, less than 1 mile northeast of the PWC Treatment Complex.

The five facilities are identified in PWC's Hazardous Waste Facility (HWF) (Part B equivalent) Permit Application. The IWTP, CST, and PCB facilities are currently permitted and seeking renewal. The ORP and CST2 are new facilities that have not previously held a HWF Permit. The ORP currently operates under a State of California Conditional Authorization Tiered Permit. The CST2 currently operates as a less-than-90-day storage area. A brief narrative description of operations at the treatment complex is provided below.

CST Facility

The CST facility is used for the temporary storage, consolidation, and repackaging of hazardous materials and wastes generated by federal government activities; and serves as a pollution prevention center.

The CST consists of an inside storage area, an outside storage area and a separate outside consolidation area. This storage area is used to store corrosive, ignitable, reactive, and toxic wastes. The facility is curbed to contain any leaks or spills that might occur. Drainage within the curbed area is to separate floor drains, which discharge to a common containment basin. The outside storage area and outside consolidation area are contained by separate 6-inch concrete curbs. Access to each area is provided by concrete ramps.

With the exception of pollution prevention efforts, the CST operates strictly as a waste consolidation and container storage facility. Waste consolidation is typically limited to the bulking of partially filled containers of paint, oily waste, solvents, and other wastes (consolidation means adding the contents of small containers, typically 5 gallons or less, to larger containers).

CST2 Facility

The CST2 facility is used for the temporary storage, consolidation, and repackaging of hazardous materials and wastes generated by federal government activities. The facility consists of an inside storage area, a covered outside consolidation/staging area, and a shipment/staging area.

The CST2 facility operates strictly as a container storage facility, with the exception of the following practices: partially filled containers of paint, oily waste, solvents, and other wastes are consolidated at the facility; and CST2 facility personnel provide lab packing services.

PCB Facility

The PCB facility is used for the temporary storage of PCB items and items suspected of containing PCBs, which are stored pending the results of laboratory testing. PCB-containing items are stored pending reuse or disposal.

IWTP

The IWTP is designed to treat phenol/general organic wastewaters, cyanide, mixed metals, chromium, contaminated oily wastewaters, non-hazardous general industrial wastes, groundwater, and if required, the ORP effluent. Oily wastes are received via tanker truck. Industrial wastes are either conveyed via the general industrial waste lined pipelines or by tanker trucks.

In addition, other waste streams listed in the permit application may be periodically batch treated using the batch treatment tanks. When tanks are used for a specific waste stream, logs, specifying contents and procedures, are kept for each batch. Additionally, an appropriate placard is used to label the tank.

Sludges produced by the various treatment processes at the IWTP are routed to the filter press system for dewatering prior to disposal. The dewatered sludge from the filter press is discharged to steel hoppers and transferred to roll-offs for temporary storage prior to disposal.

The chemicals and materials needed to treat the various waste streams are stored in bulk at the IWTP. The bulk storage of chemicals and materials ensures that adequate treatment levels can be maintained, despite temporary disruptions in the availability or delivery of those chemicals and materials. The chemicals and materials stored at the IWTP include sulfuric acid, sodium hydroxide, hydrogen peroxide, calcium hypochlorite, ferrous sulfate, sodium metabisulfite, polyelectrolytes or polymers, and GAC.

Treated wastewater is discharged to the City of San Diego sanitary sewage system in accordance with discharge requirements outlined in NASNI's Industrial User Discharge Permit.

ORP

Oily waste at NASNI is primarily generated by the operation of the Navy ships. Upon arrival in port, ships discharge their accumulated waste into pierside oily waste collection systems located along Pier J/K and the Quay Wall. From these collection systems, the oily waste is pumped through a secondarily contained oily waste pipeline to the ORP located in the PWC Treatment Complex. Oily waste is also received by tanker trucks.

Oily waste received at the ORP is composed primarily of sea water containing low concentrations of diesel fuel, lubricating oils, and heavy metals. It is treated with a combination of physical and chemical processes to remove free and emulsified oils.

REGIONAL HAZARDOUS MATERIAL MANAGEMENT PROGRAM

The Fleet and Industrial Supply Center (FISC) San Diego is the COMNAVSUPSYSCOM and CNO designated Regional Hazardous Materials Manager. Working with NASNI and other local commands, FISC is managing a program that:

- Minimizes the regional hazardous waste stream.
- Creates fully compliant facilities and processes.
- Centralizes management of hazardous materials to provide greatest consumption and visibility to all users.
- Achieves financial savings through cost avoidance for disposal (currently averaging $2.00 per pound) and new procurement.

Hazardous material is defined as any substance that is toxic, ignitable, reactive, or corrosive and that if improperly handled may be damaging to public or environmental health and well-being. The Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP) gives direction on implementing the philosophy of hazardous material minimization through source reduction, substitution, and reutilization (for example, multiple hazardous material users sharing a centralized, containerized product until the product is exhausted). CHRIMP has been mandated by CNO for all activities. A hazardous material minimization center also referred to as the HAZMIN Center (HMC) is a centrally located storage facility for HM operating under the CHRIMP process, located at NASNI, Building 1206. HMCs manage inventories and draw upon regional supply excesses before ordering new material. Safety in the work place is increased due to minimal quantities being stored there. The program ensures that all material bought is used. Saving money and minimizing storage of hazardous material with a limited shelf life that can expire and become a hazardous waste, in addition to worker safety, are important aspects of the CHRIMP program.

The HAZMART provides replenishment items to the regional HMCs when no excess supplies are available and priority group one issues for immediate use items to the fleet (paints, oils, greases, etc.). HAZMART lowers customer investment in inventories at HMCs due to short delivery times. HAZMART is co-located on NAVSTA San Diego with the HMC.

CURRENT PROGRAMS

Shop Towel Service. FISC manages a regional "shop towel" service contract that drastically reduces participants' needs to procure baled rags for cleaning/wiping up petroleum products and the disposal costs of contaminated oily rags. The contractor delivers clean rags to customers on a weekly basis and removes the used ones for laundering.

Remanufactured Laser Cartridges & Ribbons. Remanufactured laser cartridges and ribbons are available at the HAZMART. Empty cartridges may be dropped off at the HAZMART or local HMC and are then sent to a local vendor to have replacement parts and toner installed.

Lube Oil and AFFF Program. FISC assists COMNAVSURFPAC with lubrication oil from decommissioning ships and ships going into availability or overhaul. After passing a lab test, the oil is removed from one ship and offered to Navy vessels free of charge. Under this program the volumes of used oil are reduced, minimizing hazardous waste transfer and disposal. This program is currently being used for 2190 and 9250 type oils. The same principle of this program is also in place for AFFF.

Shelf-Life Training. The regional shelf-life coordinator offers individualized and group training to ships and shore activities on how to build an effective shelf-life management program and provides tools to properly extend shelf-life on qualified materials.

Results. Since the program's infancy in San Diego in 1992, it has diverted over 11 million pounds of hazardous material from the waste stream. FISC has won three environmental awards. The first was the "Environmental Responsibility Award" presented by the Industrial Environmental Association for "outstanding achievement in environmental protection." The second award was a proclamation from the San Diego County Board of Supervisors for outstanding achievement in Pollution Prevention. The third was an "Earth Day" award from Mayor Golding in recognition of the Navy's commitment to environmental protection.

RADIOLOGICAL SAFETY/MIXED WASTE MANAGEMENT PROGRAM

Please see section 3.15, Health and Safety, and Chapter 7 in Volume 1 and Appendices E and F in Volume 2.

NAVY OCCUPATIONAL SAFETY AND HEALTH (NAVOSH) PROGRAM SUMMARY

Background

The Navy has historically maintained safety and health programs to protect its personnel and property. Occupational safety has been an element of the overall Navy safety program and has been managed by Navy personnel. Other elements of the safety program included explosive safety, nuclear safety, aviation safety, and off-duty safety. The occupational health program has traditionally been conducted under the authority of the Bureau of Medicine and Surgery (BUMED) and the Chief of Naval Operations (N45).

The program gained special prominence after passage of the Occupational Safety and Health Act (OSHA) on 31 December 1970. Although the primary emphasis of OSHA was directed at the private-sector employer, Section 6 directed federal agencies to establish and maintain comprehensive and effective Occupational Safety and Health (OSH) programs.

On 26 July 1971, a presidential Executive Order (EO) 11612 entitled *Occupational Safety and Health Programs for Federal Employees* was signed. This EO stated that the federal government, as the nation's largest employer, has a special obligation to set an example for safety and healthful employment. In this regard, the head of each federal department and agency was directed to establish an OSH program in compliance with Section 19 of the OSHA. Over the next 3 years, only moderate progress was made by many federal agencies. EO 11807 was issued in 1974, which replaced EO 11612 and more clearly defined the scope, requirements, and responsibilities of federal agency programs. In addition, EO 11807 tasked the Secretary of Labor to issue guidelines designed to assist federal agencies in establishing their programs. These guidelines were issued on 9 October 1974 as Title 29, Code of federal Regulations, Part 1960 *Safety and Health Provisions for Federal Employees.*

EO 11807 was superseded in 1980 by EO 12196 Occupational Safety and Health Programs by Federal Employees, and DOL guidelines (29 CFR 1960) were revised on 21 October 1980 and reissued as Basic Program Elements for Federal Employee Occupational Safety and Health Programs.

The Department of Defense (DOD) has issued many directives and instructions to implement the federal guidance outlines above. Prominent among these are Reference 1-1, which outlines general DOD policy and procedures relative to implementation of OSHA and the associated EO, and Reference 1-2, which provides more specific guidance relative to the implementation of the basic OSH program elements specified in 29 CFR 1960.

Under the provisions of Reference 1-1, the Assistant Secretary of the Navy (Installations and Environment) (ASN [I&E]) has been appointed as the Designated Safety and Occupational Health Official for the Department of the Navy (DON), with responsibilities outlined in Reference 1-3. Reference 1-3 contains policy statements and outlines responsibilities for the implementation of the total safety and occupational health program for the Navy. The NAVOSH program is actually a major component of the total program. Reference 1-3 delegates the authority for the operational aspects of the NAVOSH program to the Chief of Naval Operations (CNO), who is specifically responsible for the issuance of appropriate implementing directives.

Program Content

The NAVOSH program is quite comprehensive. Because of the volume of material contained in the instruction, only the chapter titles are provided below to assist in the understanding of the program.

- Introduction
- Responsibilities
- Organization and Staffing
- Councils and Committees
- Prevention and Control of Workplace Hazards
- Training
- Hazardous Material Control and Management (HMC&M)
- Occupational Health
- NAVOSH Inspection Program
- Employee Reports of Unsafe/Unhealthful Working Conditions

- Inspections and Investigations of Workplaces by Federal and State OSH Officials
- Deficiency (Hazard) Abatement Program
- Navy Occupational Safety and Health Cost Data (Shore Only)
- Mishap Investigation, Reporting, and Recordkeeping
- Respiratory Protection
- Occupational Safety and Health Standards
- Asbestos Control
- Hearing Conservation and Noise Abatement
- Sight Conservation
- Personal Protective Equipment
- Lead
- Non-Ionizing Radiation
- Ergonomics Program
- Energy Control Program (Lockout/Tagout)
- Polychlorinated Biphenyls (PCBs)
- Man-Made Vitreous Fibers
- Confined Space Entry Program (Non-Maritime)
- Bloodborne Pathogens
- Occupational Reproductive Hazards
- Indoor Air Quality Management

Final Environmental Impact Statement for

Developing Homeporting Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet

Coronado, California • Bremerton, Washington
Everett, Washington • Pearl Harbor, Hawaii

VOLUME 4

PSNS Bremerton
Supplemental Documentation

July 1999

Department of the Navy

SECTION 4.1

PSNS SUPPLEMENTAL TOPOGRAPHY, GEOLOGY, AND SOILS INFORMATION

SECTION 4.1
PSNS BREMERTON SUPPLEMENTAL TOPOGRAPHY, GEOLOGY, AND SOILS INFORMATION

SEISMIC HAZARDS

Table 4.1-1 provides a brief description of the effects of earthquakes of various magnitudes, including comparisons between Richter and Modified Mercalli earthquake scales. In addition, this table defines the frequency of occurrence of earthquakes of various magnitudes worldwide.

Table 4.1-1. Earthquake Scale Definitions

Richter Scale	*Mercalli Scale*	*Effects*	*Average Number Annually (Worldwide)*
under 2	I	Imperceptible	600,000
2.0 to 2.9	II	Generally not felt	300,00
3.0 to 3.9	III, IV	Felt by people nearby. Dishes, windows, doors disturbed; walls make creaking sound	49,000
4.0 to 4.9	V	Minor shock; slight damage	6,000
5.0 to 5.9	VI	Moderate shock. Energy equivalent to an atomic bomb. Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster and damaged chimneys.	1,000
6.0 to 6.9	VII, VIII	Large shock; can be destructive in populous areas. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken.	120
7.0 to 7.9	IX, X	Major earthquake; inflicts serious damage; recorded worldwide. Fall of chimneys, factory stacks, columns, monuments, walls. Sand and mud ejected in small amounts. Changes in well water.	14
8.0 to 8.9	XI	Great earthquake producing total destruction to nearby communities; energy released is a million times that of the first atomic bomb. Few structures remain standing. Bridges destroyed; broad fissures in ground. Underground pipelines completely out of service.	One every 5 to 10 years
9.0 or more	XII	Largest earthquake. Damage total. Waves seen on ground surface. Lines of sight and level distorted.	One or two per century

Source: Bolt 1988; Richter 1958.

Kitsap County is within Seismic Zone 3, the second most dangerous earthquake category (as defined by the Uniform Building Code). There have been approximately 200 earthquakes have occurred since 1840, most of which caused little or no damage. The most recent earthquakes of high magnitude in the region were near Olympia in 1949 (7.1 on the Richter scale) and near Seattle in 1965 (6.5 on the Richter scale).

Richter magnitude 8.0 to 9.5 earthquakes may have occurred along the Cascadia thrust fault zone, located along the coast of Oregon and Washington, during the last 7,000 years. In addition, recent research indicates that large continental-crust earthquakes are possible in or near the principal urban areas of the Pacific Northwest. Given our current level of understanding, it is also likely that Benioff-zone earthquakes similar to the 1949 and 1965 events will recur (USGS 1996).

The most important issues regarding the level of earthquake hazard in the Pacific Northwest are summarized directly from the USGS (1996) as follows:

> Large, shallow crustal earthquakes are likely in the future but, at present, little is known about the recurrence of these events or their potential locations. New geologic data suggest, however, that such earthquakes are possible at locations close to urban areas and that events of this type (not necessarily on the faults near urban areas) could be as large as about Richter magnitude 8.
>
> Great earthquakes are possible on at least some segments of the Cascadia thrust fault, and most scientists believe that these earthquakes could have magnitudes at least as large as 8, although magnitudes as large as 9.0 to 9.5 have been suggested.
>
> Unfavorable ground conditions in the Puget Sound-Willamette Valley lowland are expected to substantially increase the shaking hazard at some sites, particularly for high-rise structures underlain by deep sedimentary basins.
>
> The extent of downdip rupture in a subduction earthquake on the Cascadia thrust fault will strongly control shaking levels in the principal urban areas. A model fitting both strain and uplift rates suggests that the fault could rupture downdip to points beneath the Olympic Peninsula, which would substantially increase shaking levels relative to models that limit rupture to the Pacific coast or further west.
>
> Future large Benioff-zone earthquakes are likely, and some scientists believe that these events are possible within the subducted lithosphere from western British Columbia to northwestern California. The probable depth of these earthquakes ranges between 40 and 80 km. Their maximum magnitude is likely to be between 7.5 and 8.0. Thus, earthquakes of this type appear to be possible and have locations and maximum magnitudes that would produce substantially greater damage than the historical Benioff-zone earthquakes.
>
> Progress in understanding the potential for great earthquakes or continental-crust earthquakes will come from continued paleoseismicity studies, instrumental seismicity studies, and expanded geodetic measurements. Much additional work is also need to produce useful maps that depict the effects of geologic conditions on

ground shaking and the areas of various types of ground failure. Although much remains to be done to further our understanding of the earthquake hazard in the Pacific Northwest, progress has been made in several areas.

The following is derived from the DON (1989).

When an earthquake occurs, there are three ways in which structural damage can come about: liquefaction (whereby soils suddenly lose their capacity to hold structures), differential settling of fill, and insufficient structural stability of buildings to withstand shaking. Also, these factors are often found in combination. In all cases, actual loss potential is a combination of the probability of structural failure with the use of the building. Buildings that have a high worker population and buildings that house vital functions (strategic, communications, disaster response, etc.) represent higher loss potential that other types.

Following are discussions of three sources of seismic hazard as they apply to the complex:

Liquefaction — Potential for liquefaction is based on soil type, saturation level, and earthquake intensity and duration. In the fill areas, liquefaction of the fill material becomes probable in a strong earthquake where the soil is fully saturated with groundwater. The fill layer generally extends to a depth of 20 feet; below that layer are dense and gravelly sands in which the possibility of liquefaction is negligible, even for the maximum credible earthquakes in the Bremerton area.

The upland portion of PSNS has no possibility of liquefaction. The filled lowlands, however, are susceptible to liquefaction, depending on whether soils are sufficiently saturated with water to liquefy. The groundwater table in the vicinity of the drydocks has been lowered by the underdrain operations to provide hydrostatic pressure relief for the drydocks. Consequently, there may be differential settling of the sandy fill in these areas, but they will not liquefy.

Differential Settling of Fill — Differential settling of fill, to the extent it occurs in the absence of liquefaction, is a function of differential composition and compacting of fill as it was placed. Susceptibility to differential settling will decrease with time as soils settle naturally, and is difficult to predict due to lack of information on how fill was placed.

Structural Instability — Assuming a building's foundation remains secure, its structural stability is still tested in the event of an earthquake. Most of the older buildings do not meet modern seismic stability specifications. This is especially the case with brick buildings, though some steel buildings with brick filler walls and some concrete wood buildings are also very hazardous.

Various studies have been commissioned by WESDIV on the seismic hazard of PSNS buildings. In 1973 a "Seismic Study of PSNS" was conducted by John A. Blume & Associates. This study rated buildings individually against a range of hypothetical earthquake intensities.

In 1982, Cygna Inc. completed for WESDIV "Seismic Evaluations" for 13 PSNS buildings. It found that each failed either "mission essential" or "life hazard" criteria and outlined the technique and estimated cost of remedial measures.

The "tri-service code" identifies high loss potential facilities based solely on type of construction and building use. The 1982 Master Plan contains that listing.

Finally, the 1987 Engineering Evaluations identify many buildings as having seismic design deficiencies.

These five sources produce widely different lists, which are not repeated here. None of the sources constitute a thorough ranking of potential losses. It can be generalized, however, that many if not most buildings would sustain damage in the event of a severe earthquake. Brick buildings would be the worst hit, though the list of hazardous brick buildings has shrunk considerable since 1974 due to demolitions. Other types of structures, such as storage tanks, drydocks, piers, cranes, and buried utilities may sustain damage, and in failing, may cause secondary building damage.

In conclusion, the Bremerton Naval Complex (especially PSNS) is susceptible to extensive damage in the event of an earthquake. New construction must take into account the potential for liquefaction, differential settling of fill, and shaking stresses on the structure. Existing high loss potential facilities should be remedied on a prioritized basis in order to prevent human, operational, and economic losses.

REFERENCES

Bolt, Bruce A. 1988. *Earthquakes*. New York: W.H. Freeman and Company.

DON. 1989. Master Plan Addendum, Bremerton Naval Complex, Bremerton, Washington, August.

Richter, Charles F. 1958. *Elementary Seismology*. San Francisco, W.H. Freeman and Company.

U.S. Geological Survey (USGS). 1996. *Assessing Earthquake Hazards and Reducing Risk in the Pacific Northwest. United States Geological Survey, Professional Paper 1560.*

SECTION 4.2

PSNS SUPPLEMENTAL TERRESTRIAL HYDROLOGY AND WATER QUALITY INFORMATION

SECTION 4.2
PSNS SUPPLEMENTAL TERRESTRIAL HYDROLOGY AND WATER QUALITY INFORMATION

DECLARATION OF THE RECORD OF DECISION

The following is derived directly from DON (1996)

SITE NAME AND LOCATION

Bremerton Naval Complex
Operable Unit NSC
Bremerton, Washington

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected action for Operable Unit NSC (OU NSC) at the Bremerton Naval Complex in Bremerton, Washington. This remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the maximum extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for the site.

The lead agency for this decision is the United States Navy. The Washington State Department of Ecology (Ecology) and the United States Environmental Protection Agency (EPA) have participated in the scoping of the site investigations and in evaluating alternatives for remedial action. Ecology and the EPA concur with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision, may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This operable unit is one of four being evaluated at the Bremerton Naval Complex. The remedy selected for this operable unit addresses the most immediate threats for this portion of the Complex. However, the ongoing studies being conducted for Operable Unit B (OU B) include detailed investigations of groundwater throughout the Bremerton Naval Complex and the marine environment adjacent to the Complex. If the results of these investigations indicate the need for additional remedial measures for this or other operable units of the Complex, these measures will be defined in the ROD for OU B.

The selected remedy for OU NSC includes:

- Controlling access to the Bremerton Naval Complex through security measures such as fences and signs
- Establishing administrative measures to prohibit use of groundwater from the site
- Implementing deed restrictions to limit future usage of the site
- Developing a management excavation plan to limit potential contact with, and assure appropriate handling and disposal of, soils excavated during future excavation connected with any construction activity at the site
- Upgrading site paving to reduce the possibility of contact with contaminated soil and limit the potential for precipitation to transport contaminants from soil to the groundwater
- Collecting and disposing of sediments and debris accumulated in stormdrain lines serving OU NSC
- Conducting environmental monitoring to detect any change in the quality of groundwater at the site

DECLARATION

The selected remedy is protective of human health and the environment, is in compliance with federal and state requirements that are legally applicable or relevant and appropriate to the remedy action, and is cost effective. This remedy uses permanent on-site solutions and alternative treatment or resource recovery technologies to the maximum extent practicable for this site. However, because treatment of the threats at the site was found to be not practical, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. The quantity of fill material at the site and the fact that the contaminants present occur infrequently in patterns of hot spots (due to the heterogeneous character of the fill material) make the cost of treatment excessive relative to the reduction in risk that would be achieved.

Because this remedy will result in hazardous substances remaining on site above health-based levels, long-term monitoring and institutional controls will be implemented and periodic reviews will be conducted at least every 5 years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

(ROD signed by EPA on December 12, 1996 [personal communication, J. Jeffrey].)

NATURE AND EXTENT OF CONTAMINATION

The remedial investigation for OU NSC included sampling and analysis of soil, groundwater, stormdrain water, and stormdrain sediments from the site. Figure 4.2-1 depicts the locations sampled at OU NSC.

The laboratory results reported here typically include analyses performed on samples collected during the pre-RI site inspection (SI) of 1990-91, as well as both Phase I (1993) and Phase II (1994) of the RI.

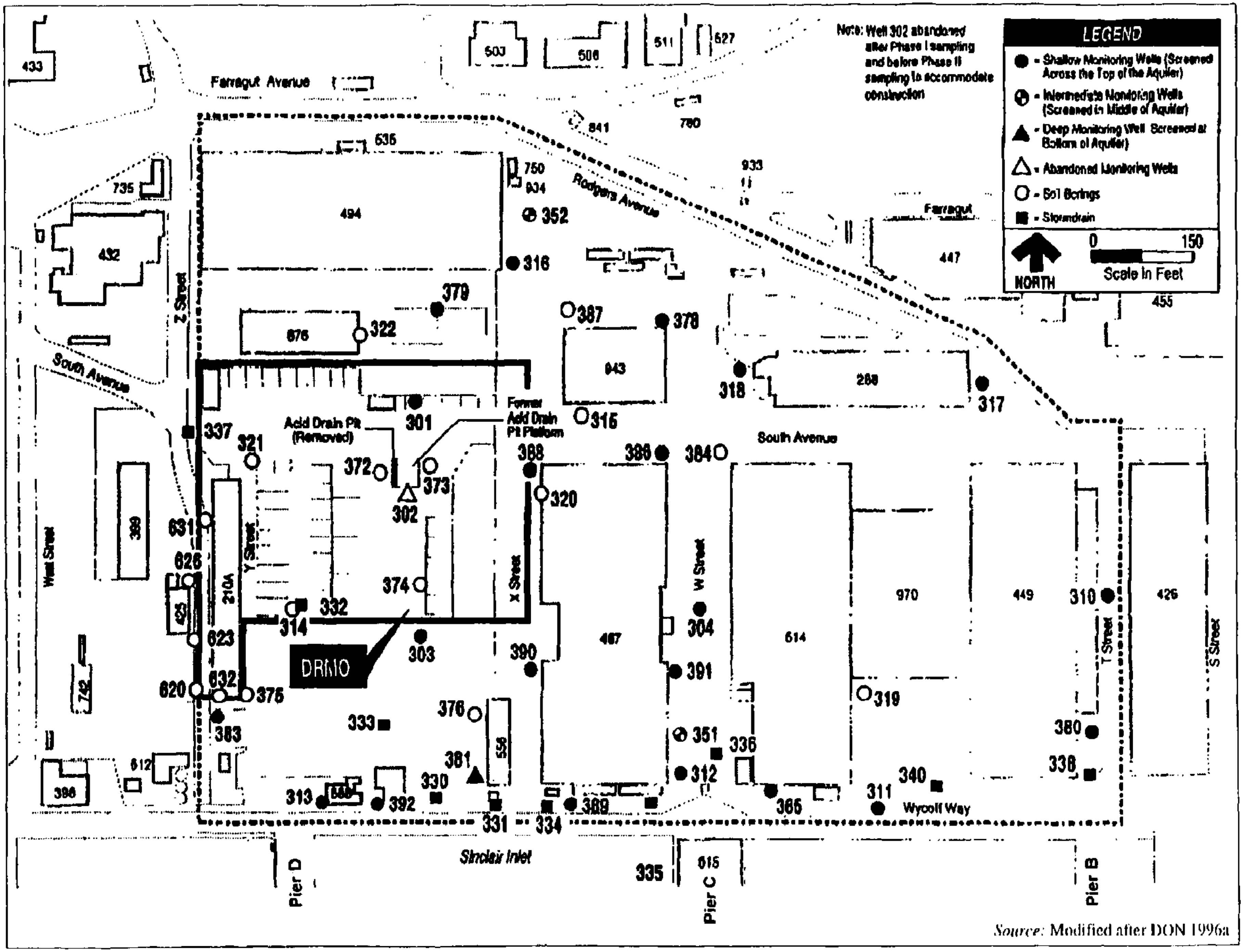


Figure 4.2-1. Sampling Locations Operable Unit NSC

The degree of contamination was assessed by comparing analytical data to State of Washington Model Toxics Control Act (MTCA) screening levels, water quality criteria, and, for inorganics, local PSNS-area background concentrations. Tables summarizing the investigation findings in this section typically show comparisons to the lowest of several screening levels available for each chemical. OU NSC meets the MTCA definition of an industrial site (MTCA 173-340-745): it is officially designated for industrial use, has a history of industrial use, is surrounded by industrial area, and is expected to remain in industrial use for the foreseeable future.

Ecology has developed several groups of MTCA screening levels, designated Methods A, B, and C, based on human health risk considerations. The Method A values are derived from federal Safe Drinking Water Act standards, water quality criteria, and risk assessment calculations. The Method B values are the result of risk assessment calculations based on highly conservative assumptions, for example involving a residential land use scenario, an increased cancer risk of 1 in 1,000,000, and a Hazard Index of 1. Method B typically includes the lowest numerical standards of the three methods. Method C values theoretically represent less conservative standards than Method A or B, but additional conditions must be satisfied to use Method C values. For both Methods A and C a second set of soil standards applicable to industrial sites exist. The basis for the specific standard used for screening (i.e., residential versus industrial) is noted where appropriate in the summary tables included in this section.

For inorganic analyses in soil and groundwater, results were also compared to local background values — statistically derived values representing expected naturally occurring concentrations. These background concentrations were based on samples collected in the upland portion of the Complex, where there is little chance of contamination having occurred. For water media, comparisons were also made to state and federal water quality criteria.

Soils

Analytical results from samples collected from soil subsequently removed during the DRMO soil removal action are generally not included in the following presentations. However, results from samples collected from soils *left in place* at DRMO are included in these discussions.

A total of 318 soil samples were collected from 66 soil borings at depths ranging from the ground surface to the bottom of the sea level aquifer. Soil samples were collected and analyzed for the EPA target compound list (TCL) organic analytes, including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and PCBs; for the target analyte list (TAL) organics (metals); and for petroleum hydrocarbons using State of Washington total petroleum hydrocarbon (WTPH) methods.

The results were screened against the lowest of the MTCA Method B or C values for soil; if no Method B or C values were available Method A values were used.

The majority of the unconsolidated materials encountered at OU NSC consist of fill materials, including both engineered backfill such as sand, gravel, and soil, and miscellaneous industrial waste. Samples were collected from both the fill and underlying native soil.

Volatile Organic Compounds

Fifty soil samples collected at various depths from 11 soil borings/monitoring wells were analyzed for 34 TCL VOCs. Thirteen VOCs were detected in soils at OU NSC (Table 4.2-1); however, none were detected above screening levels.

Semivolatile Organic Compounds

One hundred seventy-seven soil samples collected from 38 soil borings/monitoring wells were analyzed for 43 SVOCs. Table 4.2-2 summarizes the SVOCs detected at OU NSC, the frequency of detection, the minimum and maximum concentrations reported, the screening level, and the number of samples that exceeded the most stringent screening level. Thirty-one SVOCs were detected in soil at OU NSC. Concentrations of seven SVOCs exceeded the screening levels: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)-anthracene, chrysene, and idneno(1,2,3-cd)pyrene. All seven of these compounds are classified as carcinogenic polycyclic aromatic hydrocarbons (cPAHs). Exceedances of screening levels by these SVOCs were widespread at OU NSC. However, most of the highest concentrations were found in the southwest part of the site bounded by South Avenue and Wycoff Way at depths of 5 feet or more.

Pesticides/Aroclors (PCBs)

As shown in Table 4.2-3, 15 chlorinated pesticides were detected in 74 soil samples and two PCB congeners were detected in 176 soil samples at OU NSC. No pesticides exceeded screening levels, but both PCBs did. The PCB exceedances were found in shallow samples collected just north and south of DRMO and in subsurface soils left in place at DRMO after the soil removal.

Total Petroleum Hydrocarbons

Table 4.2-4 summarizes results for analysis of total petroleum hydrocarbons (TPH) in 36 soil samples. Four fractions of TPH were detected in subsurface soils at OU NSC: TPH as motor oil (TPH—motor oil), TPH as gasoline (TPH—gasoline), TPH as diesel (TPH— diesel), and TPH (total). Exceedances of screening levels occurred for all four TPH fractions. TPH exceedances of screening levels were distributed throughout OU NSC. Many of the highest observed concentrations were found adjacent to Building 467, in the rights-of-way of South Avenue, W Street, Wycoff Way, and X Street, and in the vicinity of Building 588 in the southwest corner of the site.

Inorganic Compounds

Twenty-three inorganic analytes were detected in 174 surface and subsurface soil samples at OU NSC. Thirteen inorganics exceeded the screening levels at least once. Table 4.2-5 summarizes all detected organics, the frequency of detection, the minimum and maximum concentrations reported, the screening levels, and the number of samples that exceeded the screening levels. The inorganic analytes aluminum, calcium, magnesium, potassium, iron, and sodium are not associated with toxicity to humans under normal circumstances. Most of these chemicals are essential human nutrients, and all are either nontoxic or toxic only at very high concentrations.

1

Table 4.2-1. Volatile Organic Compounds Detected in Soil						
			Range of Concentrations			
Chemical	Number of Samples	Number of Detections	Minimum (mg/kg)	Maximum (mg/kg)	Screening Level [a] and Source (mg/kg)	Number of Samples Exceeding Screening Level
Acetone	50	32	0.006	0.73	8,000—MTCA B	0
Carbon disulfide	50	3	0.001	0.004	8,000—MTCA B	0
Chlorobenzene	50	3	0.001	0.002	1,600—MTCA B	0
1,1-Dichloroethane	50	1	0.008	0.008	8,000—MTCA B	0
1,2-Dichloroethene	50	2	0.008	0.009	800—MTCA B	0
Ethylbenzene	50	6	0.003	0.1	8,000—MTCA B	0
Methylene chloride	50	18	0.002	0.014	133—MTCA B	0
1,1,2,2-Tetrachloroethane	50	1	0.02	0.02	5—MTCA B	0
Tetrachloroethene	50	9	0.003	0.17	19.6—MTCA B	0
Toluene	50	5	0.001	0.016	16,000—MTCA B	0
1,1,2-Trichloroethane	50	1	0.012	0.012	17.5—MTCA B	0
Trichloroethene	50	4	0.004	0.3	90.9—MTCA B	0
Xylenes	50	5	0.011	0.14	160,000—MTCA B	0

Notes: a. The lowest of MTCA Method B, C or C Industrial screening levels (or MTCA A if no B or C level exists).
Table does not include results for samples collected from soil subsequently removed during DRMO soil removal.

2

Table 4.2-2. Semivolatile Organic Compounds Detected in Soil						
			Range of Concentrations			
Chemical	Number of Samples	Number of Detections	Minimum (mg/kg)	Maximum (mg/kg)	Screening Level [a] and Source (mg/kg)	Number of Samples Exceeding Screening Levels
Acenaphthene	177	24	0.043	12	4,800—MTCA B	0
Acenaphthylene	177	6	0.025	0.14	—	—
Anthracene	177	34	0.015	24	24,000—MTCA B	0
Benzo(a)anthracene	177	57	0.036	39	0.137—MTCA B	36
Benzo(a)pyrene	177	53	0.036	36	0.137—MTCA B	38
Benzo(b)fluoranthene	177	61	0.019	53	0.137—MTCA B	46
Benzo(g,h,i)perylene	177	39	0.026	25	—	—
Benzo(k)fluoranthene	177	61	0.019	69	0.137—MTCA B	45
Bis(2-ethylhexyl)phthalate	177	60	0.026	0.92	71.4—MTCA B	0
Butylbenzylphthalate	177	3	0.054	0.93	16,000—MTCA B	0
Carbazoic	140	13	0.042	16	50—MTCA B	0
Chrysene	177	69	0.026	36	0.137—MTCA B	41
Di-n-butylphthalate	177	5	0.03	0.056	8,000—MTCA B	0
Di-n-octylphthalate	177	16	0.51	0.48	1,600—MTCA B	0
Dibenz(a,h)anthracene	177	23	0.038	6.2	0.137—MTCA B	12
Dibenzofuran	177	17	0.028	6.9	—	—
1,2-Dichlorobenzene	120	1	0.05	0.05	7,200—MTCA B	0
1,3-Dichlorobenzene	120	1	3.1	3.1	—	—
2,4-Dimethylphenol	177	1	0.2	0.2	1,600—MTCA B	0
Fluoranthene	177	67	0.026	69	3,200—MTCA B	0
Fluorene	177	24	0.025	15	3,200—MTCA B	0
Indeno(1,2,3-cd)pyrene	177	43	0.022	23	0.137—MTCA B	31
Isophorone	177	1	1.1	1.1	1,050—MTCA B	0
2-Methylnaphthalene	177	29	0.023	17	—	—
4-Methylphenol	177	3	0.045	0.25	400—MTCA B	0
Naphthalene	177	26	0.04	23	320—MTCA B	0
4-Nitrophenol	177	1	0.055	0.055	—	0
Phenathrene	177	63	0.027	80	—	—
Phenol	177	8	0.043	0.077	48,000—MTCA B	0
Pyrene	177	80	0.035	83	2,400—MTCA B	0
1,2,4-Trichlorobenzene	177	2	0.042	2.5	800—MTCA B	0

Notes: a. The lowest of MTCA Method B, C or C Industrial screening levels (or MTCA A if no B or C level exists).
Table does not include results for samples collected from soil subsequently removed during DRMO soil removal.
— No MTCA screening levels have been established.

Table 4.2-3. Pesticide/Aroclor Compounds Detected in Soil

Chemical	Number of Samples	Number of Detections	Range of Concentrations		Screening Level [a] and Source (mg/kg)	Number of Samples Exceeding Screening Level
			Minimum (mg/kg)	Maximum (mg/kg)		
alpha-BHC	74	1	0.00099	0.00099	0.159—MTCA B	0
alpha-Chlordane	74	5	0.00044	0.014	0.769—MTCA B	0
Aroclor 1254	176	6	0.13	1.615	0.13—MTCA B	6
Aroclor 1260	176	18	0.008	3.165	0.13—MTCA B	7
4,4'-DDD	74	9	0.00038	0.023	4.17—MTCA B	0
4,4'-DDE	74	6	0.00029	0.0016	2.94—MTCA B	0
4,4'-DDT	74	9	0.00035	0.0093	2.94—MTCA B	0
delta-BHC	74	1	0.00017	0.00017	72.9—MTCA C Ind.	0
Dieldrin	74	4	0.00032	0.00089	0.0625—MTCA B	0
Endosulfan I	74	1	0.00047	0.00047	—	—
Endosulfan II	74	2	0.00062	0.0012	—	—
Endosulfan sulfate	74	9	0.00033	0.0023	—	—
Endrin	74	1	0.00032	0.00032	24	0
Endrin ketone	74	10	0.00042	0.047	—	—
gamma-Chlordane	74	6	0.00021	0.0031	0.769—MTCA B	0
Heptachlor epoxide	74	9	0.00026	0.003	0.11—MTCA B	0
Methoxychlor	74	2	0.00066	0.00079	400—MTCA B	0
PCB (total)	176	20	0.008	3.665	0.13—MTCA B	8

Notes: a. The lowest of MTCA Method B, C or C Industrial screening levels (or MTCA A if no B or C level exists).
Table does not include results for samples collected from soil subsequently removed during DRMO soil removal.
PCB = Polychlorinated biphenyls.
— No MTCA screening levels have been established.

No screening levels are established for these inorganics. Five other inorganic analytes exceeded screening levels. Although these exceedances were distributed throughout OU NSC, many of the highest concentrations were found in three areas: DRMO and the adjacent portion of X Street, W Street south of South Avenue, and the extreme southwest corner of the site, near Buildings 588 and 210A.

Table 4.2-4. Total Petroleum Hydrocarbons Detected in Soil

Chemical	Number of Samples	Number of Detections	Range of Concentrations		Screening Level and Source (mg/kg)	Number of Samples Exceeding Screening Level
			Minimum (mg/kg)	Maximum (mg/kg)		
TPH	23	17	32.5	20,400	200—MTCA A	14
TPH-Diesel	36	32	14	41,000	200—MTCA A	10
TPH-Gasoline	10	3	90	320	100—MTCA A	2
TPH-Motor oil	29	23	29.4	12,000	200—MTCA A	15

Note: TPH = Total petroleum hydrocarbons.

Groundwater

The results of laboratory analyses of groundwater samples were screened against MTCA B surface water values, the National Toxics Rule for consumption of organics, and state and federal water quality criteria. Surface water standards rather than drinking water standards were used because groundwater at OU NSC is not potable due to the influence of seawater.

Volatile Organic Compounds

Of the 19 volatile organic compounds detected in 49 groundwater samples analyzed from 31 wells, only trichloroethene (TCE) exceeded screening levels.

Semivolatile Organic Compounds

Of the 19 semivolatile organic compounds detected in 36 groundwater samples, six were detected at concentrations exceeding screening levels. Most of the exceedances involved bis(2-ethylhexyl)phthalate, a common laboratory contaminant. All of the other exceedances occurred at a single location at DRMO.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) consist of medium-specific or operable unit-specific goals for protecting human health and the environment. The objectives should be as specific as possible, but not so specific that the range of alternatives that can be developed is unduly limited. RAOs were developed for OU NSC for those chemicals of concern identified by comparing laboratory results to chemical-specific regulations and as a result of the baseline risk assessment. The regulations addressed in the RI report include MTCA cleanup levels that focus on water quality standards and on human exposure via direct contact or via ingestion of soil, groundwater, or marine life.

Land use at OU NSC is expected to remain industrial in the future based on the important role of the Bremerton Naval Complex. The RAOs for soil were developed on this basis for human ingestion and contact. RAOs for soil for protection of adjacent surface water will be developed as part of the OU B ROD if appropriate.

The general conclusion of the baseline risk assessment is that the predicted cancer and noncancer risks posed by chemicals at OU NSC are below or within established acceptable ranges. However, lead concentrations observed in soil, but not included in the calculated risks, present a health risk to site workers and hypothetical future residents.

GROUNDWATER

Much of the groundwater beneath OU NSC is not suitable for use as drinking water because seawater intrusion makes it too salty. Therefore, cleaning up the groundwater to drinking water standards is not an objective. However, preventing accidental contact with groundwater is an objective.

Although groundwater is not of concern related to human use, it may represent a pathway for migration of contaminants to the marine environment (Sinclair Inlet). Most of the groundwater beneath OU NSC flows toward Drydock 6 as a result of the nearly constant drydock dewatering operation. Groundwater seeps through weep holes in Drydock 6 and combines with other flows into the drydock, and the sum of these flows is released into Sinclair Inlet. When Drydock 6 is not being dewatered, the natural flow of OU NSC groundwater is toward Sinclair Inlet. Also, at low tides some of the groundwater at the site discharges directly to Sinclair Inlet, rather than via

Drydock 6. By whatever pathway, the movement of groundwater from OU NSC to Sinclair Inlet has the potential to transport dissolved chemicals to the marine environment. Thus, it is possible that the OU NSC contaminants could contribute to adverse effects in marine life in the Inlet. To evaluate the potential of adverse marine effects, the concentrations of chemicals in groundwater and Drydock 6 seeps were (1) compared to surface water quality criteria and (2) modeled to determine the fate and transport of chemicals of concern from groundwater to Sinclair Inlet.

Chemicals that frequently exceeded surface water quality criteria in groundwater collected from OU NSC included TPH, copper, and nickel. Pesticides (alpha- and gamma-chlordane, 4,4'-DDT, etc.), PCBs, arsenic, and silver exceeded surface water criteria at less than 10 percent of the groundwater sampling locations. Samples of seep water entering the northwest end of Drydock 6 contained arsenic and lead in exceedance of surface water standards. The detection limits for pesticides and PCBs in the northwestern Drydock 6 seep samples exceeded the surface water criteria. Therefore, it is uncertain, based on these tests, whether pesticides and PCBs exist at levels of concern. However, since both pesticides and PCBs were detected in OU NSC groundwater and other drydock samples, these chemicals remain of concern.

The fate and transport modeling of chemicals in the OU NSC groundwater indicated that, under present site conditions, the mass flux of contaminants in groundwater discharging into the marine water does not appear to significantly affect ambient concentrations in Sinclair Inlet. This is because OU NSC groundwater is diluted with Sinclair Inlet water and other groundwater as it enters Drydock 6. This indicates that OU NSC groundwater probably does not represent a significant risk to the marine environment. Because of some uncertainties associated with the modeling and the need to evaluate groundwater at the Naval complex as a whole (since there are no geographical boundaries between OU NSC and OU B), the groundwater to surface water pathway will be further evaluated for the entire complex as part of the OU B RI/FS groundwater modeling and ecological risk assessment.

Because groundwater contamination does not appear to present an unacceptable risk to humans (since it is not potable) or the environment (modeling showed rapid dilution with Sinclair Inlet water prior to discharge), active remedial measures (e.g., collection and treatment, containment) were not selected under this ROD. However, those chemicals that frequently exceeded surface water standards in groundwater have been identified as discharging to Sinclair Inlet at levels exceeding surface water standards in seeps should be monitored to ensure that the conclusion that the site presents low risk continues to be justified. Also, groundwater impacts should be considered where remedies are selected for other media. Therefore, the RAO established for groundwater is to reduce the potential for arsenic, copper, nickel, lead, pesticides, PCBs, and TPH to reach the groundwater, to the extent feasible using technologies that are implementable and effective for the site. The remediation goals for these chemicals are shown in Table 4.2-6.

If additional remedial measures are determined to be necessary for OU NSC groundwater as a result of the OU B modeling and ecological risk assessment, these measures will be defined in the ROD for OU B.

Table 4.2-6. Groundwater Cleanup Levels for OU NSC					
Parameter	*CAS #*	*Regulatory Level (μg/L)*	*Basis*	*Practical Quantitation Limit (μg/L0*	*Cleanup Level [a] (μg/L)*
Arsenic	7440-38-2	0.0982	MTCA B	0.5	0.5
Copper	7440-50-8	2.5	State WQC	2.5	2.5
Lead	7439-92-1	5.8	State WQC	5	5.8
Nickel	7440-02-0	7.9	State WQC	5	7.9
alpha-BHC	319-84-6	0.00791	MTCA B	0.01	0.01
alpha-Chlordane	57-74-9	0.000354	MTCA B	0.01	0.01
4,4'-DDT	50-29-3	0.000356	MTCA B	0.02	0.02
gamma-Chlordane	57-74-9	0.000354	MTCA B	0.01	0.01
Total PCBs	1336-36-3	0.000027	MTCA B	0.2	0.2
Total Petroleum Hydrocarbons	—	1,000	MTCA A	250	1,000

Notes: a. Cleanup level established as the higher of the regulatory level or the PQL; see WAC 173-340-700(6) and Ecology Implementation Memo #3 of November 24, 1993.
Based on protection of adjacent surface waters of Sinclair Inlet.
— No CAS # available.

SOILS

The chemicals in soils at OU NSC for which remedial actions were considered are carcinogenic polycyclic aromatic hydrocarbons, PCBs, lead, and total petroleum hydrocarbons. These chemicals were selected based on exceedances of industrial standards and, in the case of lead and TPH, potential risk to future residents or site workers.

In general, the highest concentrations of cPAHs were found at depths great enough to avoid a health risk under present site uses. Polycyclic aromatic hydrocarbons (PAHs) may have been present in the fill material used to develop the site; they could also be connected with petroleum contamination.

The highest lead concentrations measured at OU NSC were found in the vicinity of the DRMO. This lead is believed to have resulted from battery storage and recycling activities in this area. Soil removed from the unpaved area at DRMO during the interim soil removal action included soil associated with several of the highest lead concentrations. However, elevated lead levels were also measured in the soil left in place below the excavation. Lead is also believed to have been present in the fill material used to develop OU NSC, and lead in comparatively common in soils throughout much of the site.

TPH is also pervasive at OU NSC. Many of the highest measured concentrations were found in the area east and north of Building 467, largely coinciding with the primary Bremerton Complex fuel oil supply lines and associated pump and storage facilities. High TPH concentrations were also reported from the vicinity of the oil-water separator at Building 588, in the southwest corner of OU NSC.

The RAO for soil is to reduce human exposure to the chemicals of concern and to reduce or control contamination of groundwater. The risk assessment demonstrated that potential inhalation of soil particles is a comparatively minor source of risk. The soil exposure pathways to be controlled are direct contact with and ingestion of soil. Based on the results of the risk assessment and

Table 4.2-7. Soil Cleanup Levels for OU NSC

Parameter	*CAS #*	*Regulatory Level (µg/L)*	*Basis*	*Practical Quantitation Limit (µg/L0*	*Cleanup Level (µg/L)*
Lead	7439-92-1	1,000	MTCA A Industrial	5	1,000
Individual cPAHs	56-5-3; 50-32-8; 205-99-2; 207-08-9; 218-01-9; 53-70-3; and 193-39-5	18	MTCA C Industrial	1	18
Total PCBs	1336-36-3	17	MTCA C Industrial	0.1	17
Total Petroleum Hydrocarbons	—	200	MTCA A	25	200

Notes: Based on industrial site usage; soil cleanup levels based on protection of adjacent surface waters of Sinclair Inlet will be defined, if appropriate, in the ROD for Operable Unit B.
— No CAS # available.

comparison to MTCA industrial standards, the chemicals of concern in the soil are lead, cPAHs, PCBs, and TPH. The remediation goals for these chemicals are shown in Table 4.2-7.

REFERENCES

DON. 1996. Final Record of Decision, OU NSC, U.S. Navy CLEAN Contract, Engineering Field Activity, Northwest. December 12.

SECTION 4.3

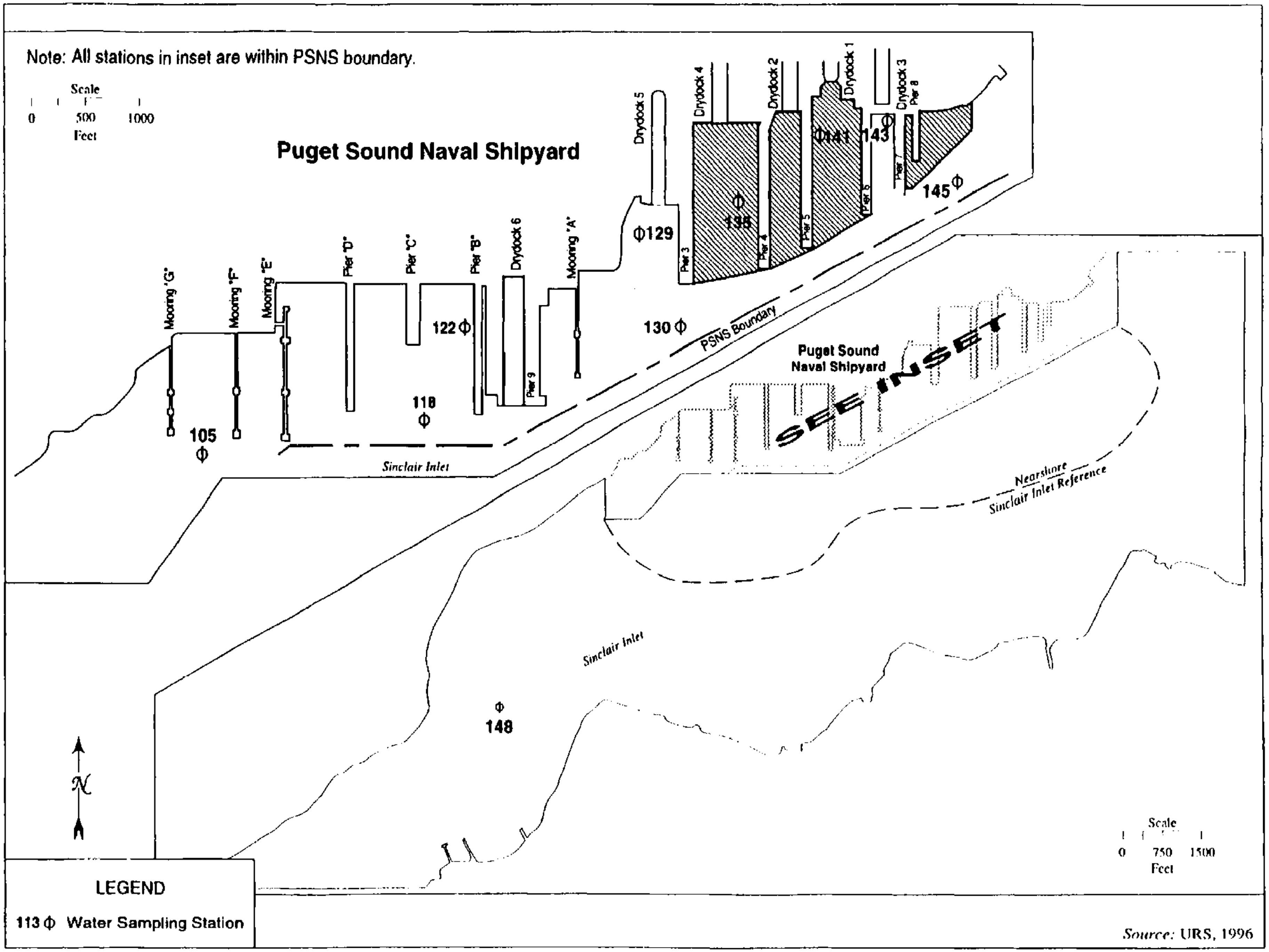
PSNS SUPPLEMENTAL WATER QUALITY INFORMATION

SECTION 4.3

PSNS BREMERTON SUPPLEMENTAL WATER QUALITY INFORMATION

Water sampling locations are shown in Figure 4.3-1.

This section also includes two reports that present the results of the study of bottom sediment suspension at PSNS by propeller-generated currents from Navy ships.



Source: URS, 1996

Figure 4.3-1. Water Sampling Locations, PSNS

PROPELLER WASH RESUSPENSION PREDICTIONS

INTRODUCTION

The resuspension of bottom sediments by tugboat propeller wash during docking operations at PSNS is of concern for this environmental investigation. This appendix describes an analysis procedure that estimates the bottom sediment rate of resuspension due to tugboats and the differences in total sediment resuspension rates expected in the environmental alternatives considered in the EIS. Near-bottom current velocities caused by the propeller wash of a Navy tugboat were measured at four locations during a field experiment conducted on June 24, 1998. Numerical predictions were made for the tugboat using an advanced computational fluid dynamics (CFD) model. Comparisons between the measured and predicted data at two of the four locations were then used to estimate a current speed factor that is applied to convert the predicted velocities to "calibrated" predicted velocities. The calibrated predicted velocities are then used to estimate the rates of total mass of resuspended material per minute due to tug boat operation at either high or low tide. The sedimentation rates are then used to estimate the effects of different alternative actions using a representative tug boat operation. This operation was an undocking procedure of the carrier USS CARL VINSON from a pier at PSNS on April 29, 1998.

CURRENT MEASUREMENTS

A field experiment was conducted at the PSNS on June 24, 1998 shortly after a low tide of -2.8 feet in waters having depth of 42 feet. An array of current meters was placed in the array offshore of a pier at PSNS (shown in Figure 1). The four current meters used in this appendix are denoted 1851, 1708, 1709, and 1678. A Navy tugboat was then used to generate propeller wash by pushing on a set of end piling of the pier at three operational propeller speeds starting at 50 RPM (for about 30 minutes), then increasing to 100 RPM (for about 30 minutes), and finally increasing to 140 RPM for about 30 minutes. At the beginning of the last 30-minute period, the propeller speed was first increased to 150 RPM from 100 RPM, but was shortly reduced to 140 RPM for operational safety of the tug. The E-W and N-S components of current velocity, and current speed for each of the four current meters are shown in Figures 2, 3, 4, and 5 for meters labeled 1708, 1709, 1851, and 1678, respectively. The 50 RPM test started at 20:38 GMT, the 100 RPM test started at 21:08 GMT, and the full power 150 RPM started at 21:40 GMT. As noted before, the propeller speed was reduced to 140 RPM shortly thereafter. The current meter labeled 1678 was not operational in the water until about 21:05 GMT, and hence this meter did not record currents during the 50 RPM test.

The measured current velocity and speed data shown in these figures suggest several conclusions. The short time variations in current velocity in the records for current meters labeled 1851 and 1678 are much higher than for current meters labeled 1708 and 1709. This indicates that the current meters labeled 1851 and 1678 are in the turbulent propeller wash jet, while the current meters labeled 1708 and 1709 are off to a side of the jet and are measuring the entrained ambient flow into the jet. Because the average time used to measure current velocity for current meters labeled 1851 and 1678 did not exceed one second, the data from these meters are assumed to include turbulent components. The current meter labeled 1708 is much closer to the jet than the current meter labeled 1709. The records also show longer time scale variations on the order of many minutes. These are thought to be caused by variations in tug boat heading, which varied during the experiment within a range of several degrees as well as the passing of eddies having an unknown range of length and time scales.

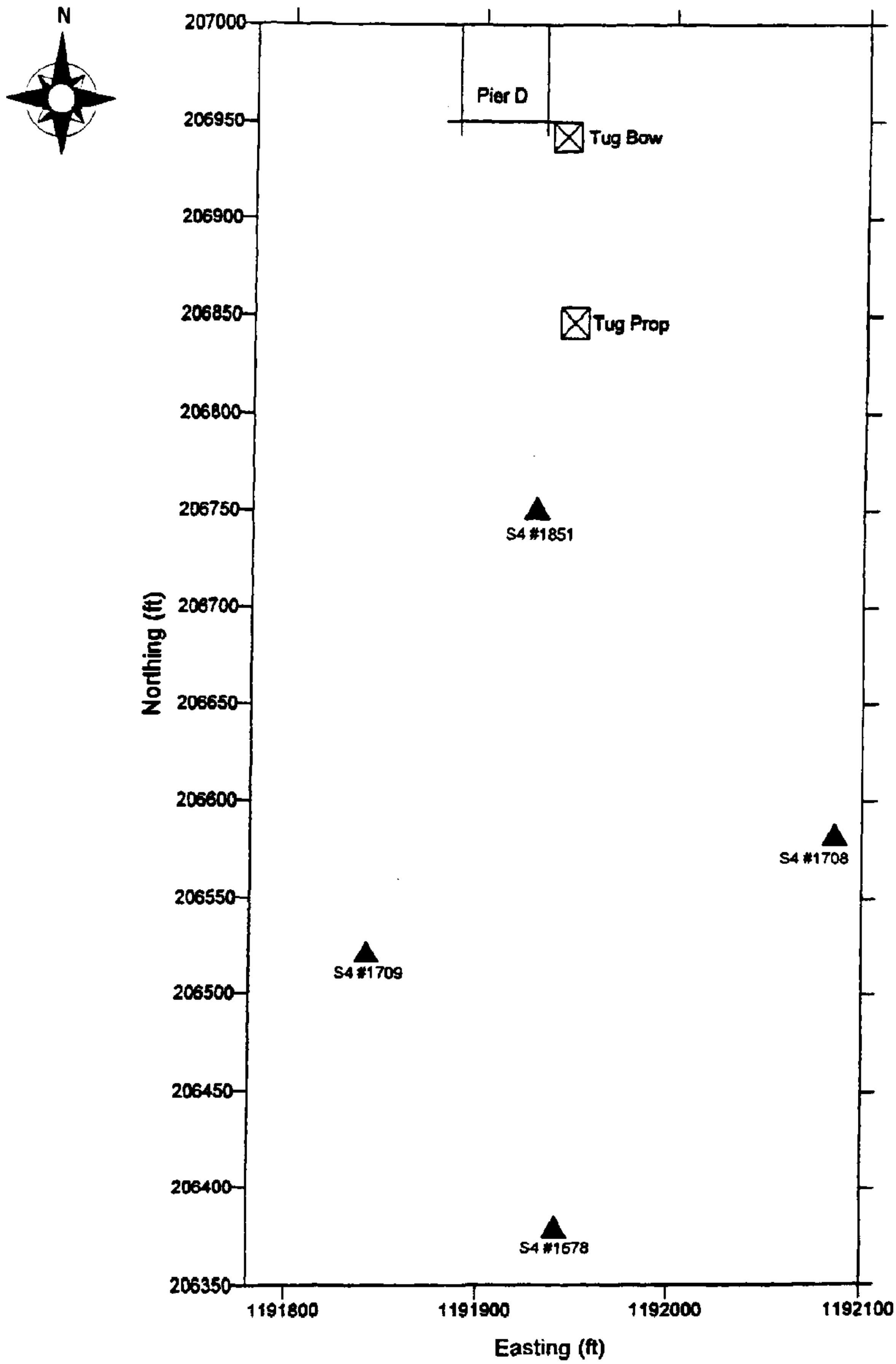


Figure 1. Deployed current meter and tug boat locations, PSNS Prop Wash Study. NAD State Plane Coordinates, WA North. June 24, 1998.

Prop Wash Experiment - S/N 1708

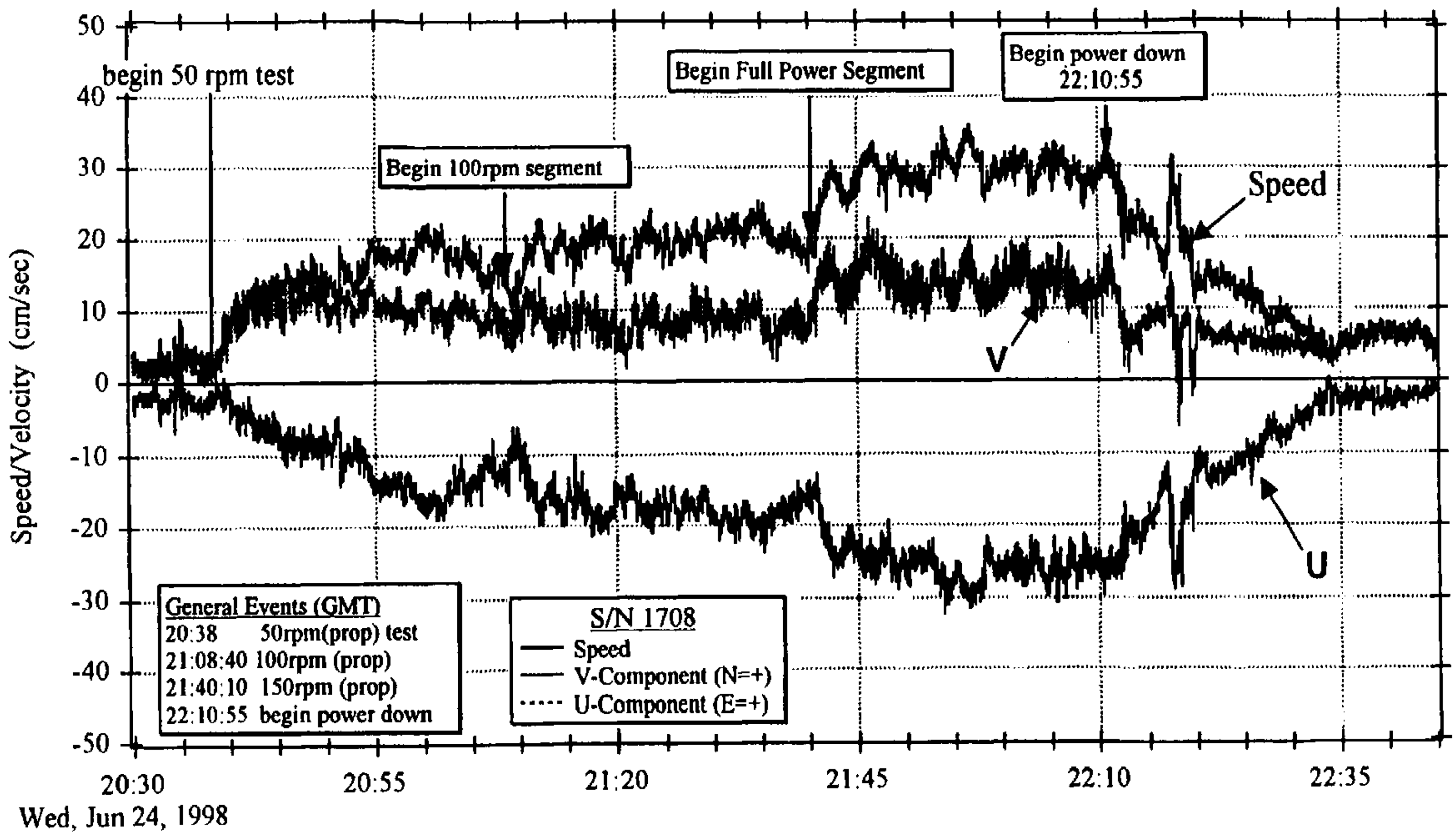


Figure 2. Data from Current Meter 1708. "U" represents the east-west component, depending on sign. "V" represents the north-south component. Speed is the combined vector of the "U" and "V" components and is always positive.

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Prop Wash Experiment - S/N 1709

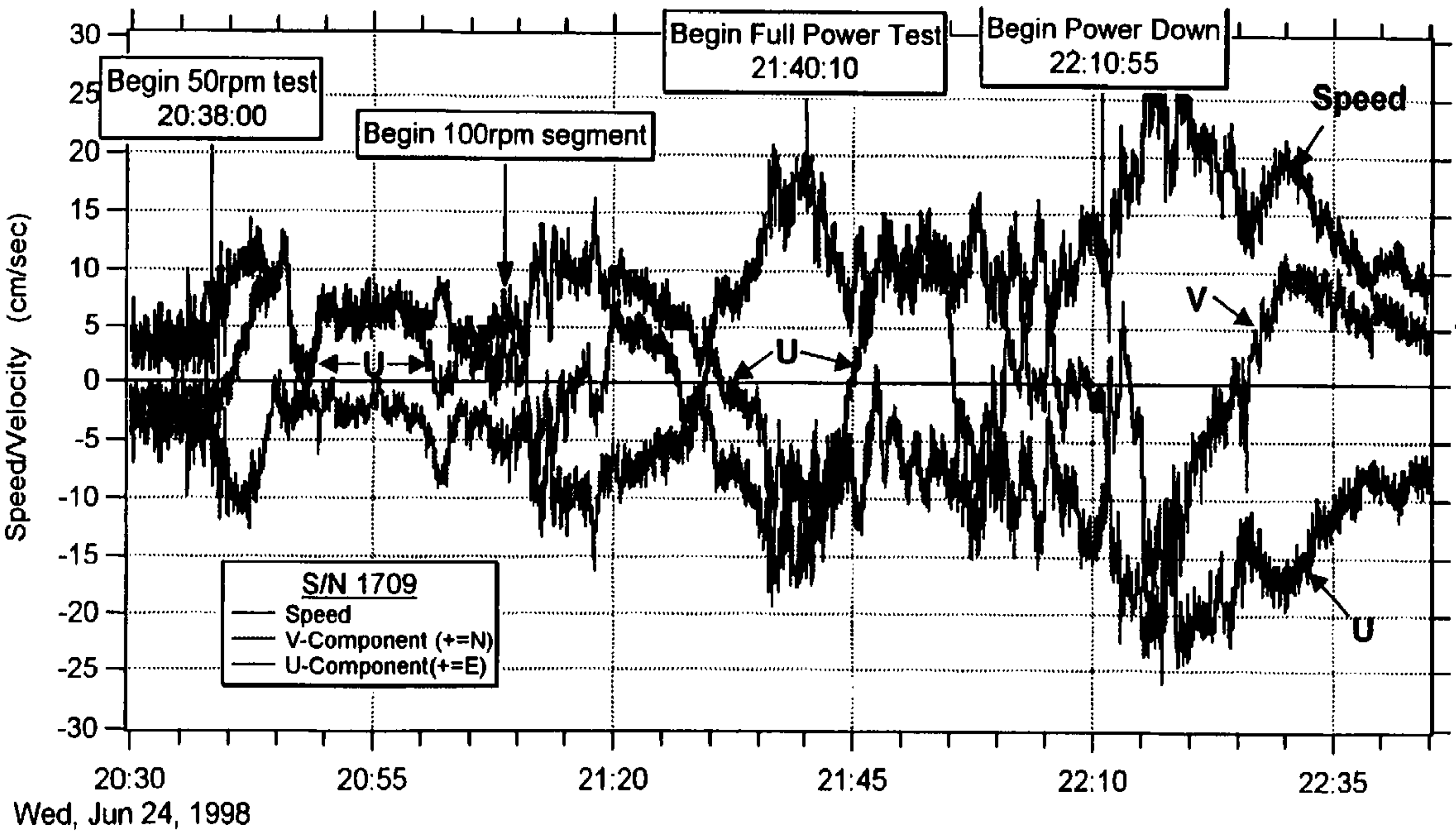

Figure 3. Data from Current Meter 1709.

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Prop Wash Experiment - S/N 1851

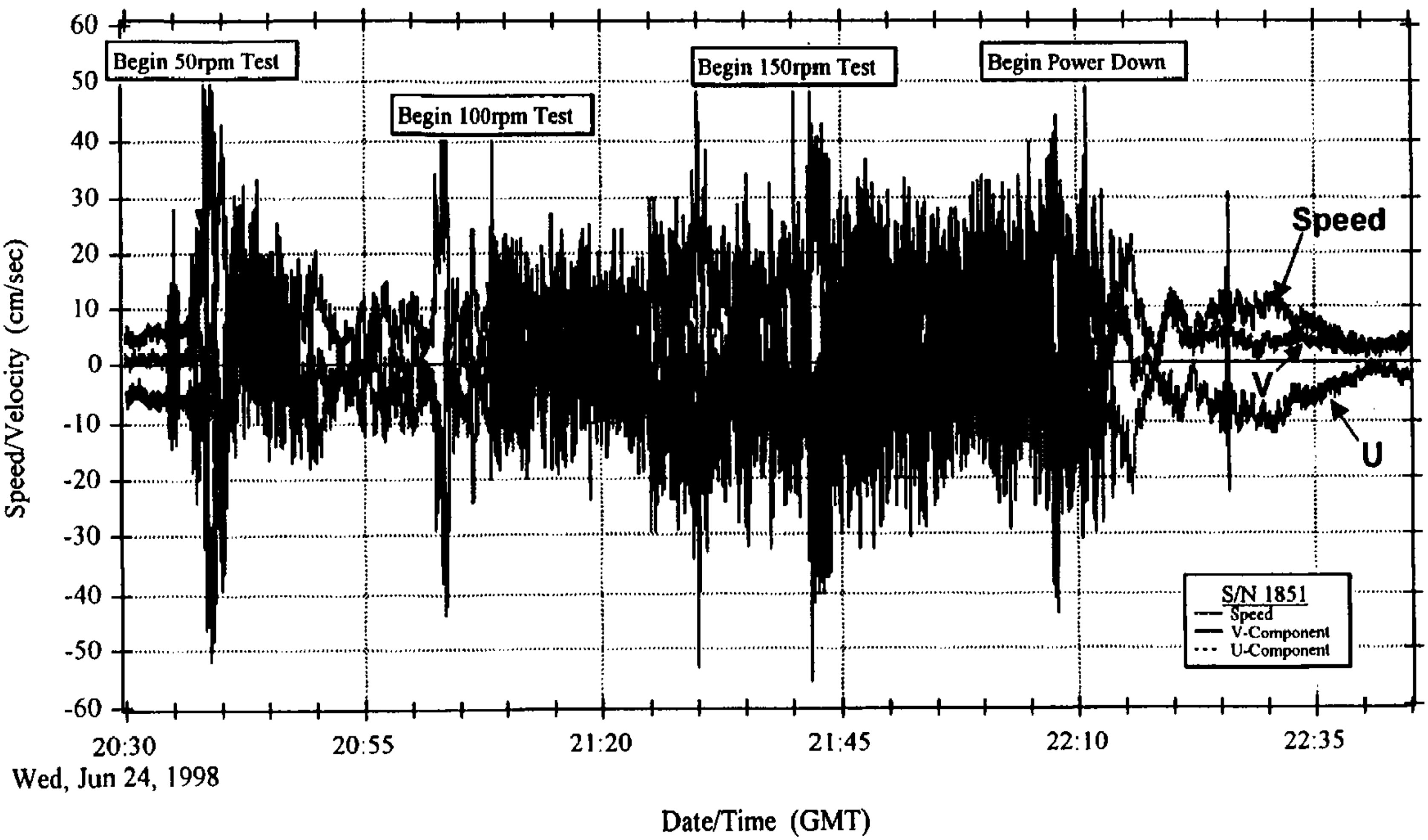

Figure 4. Data from Current Meter 1851.

Prop Wash Experiment - S/N 1678

Green Box says Instrument In Water

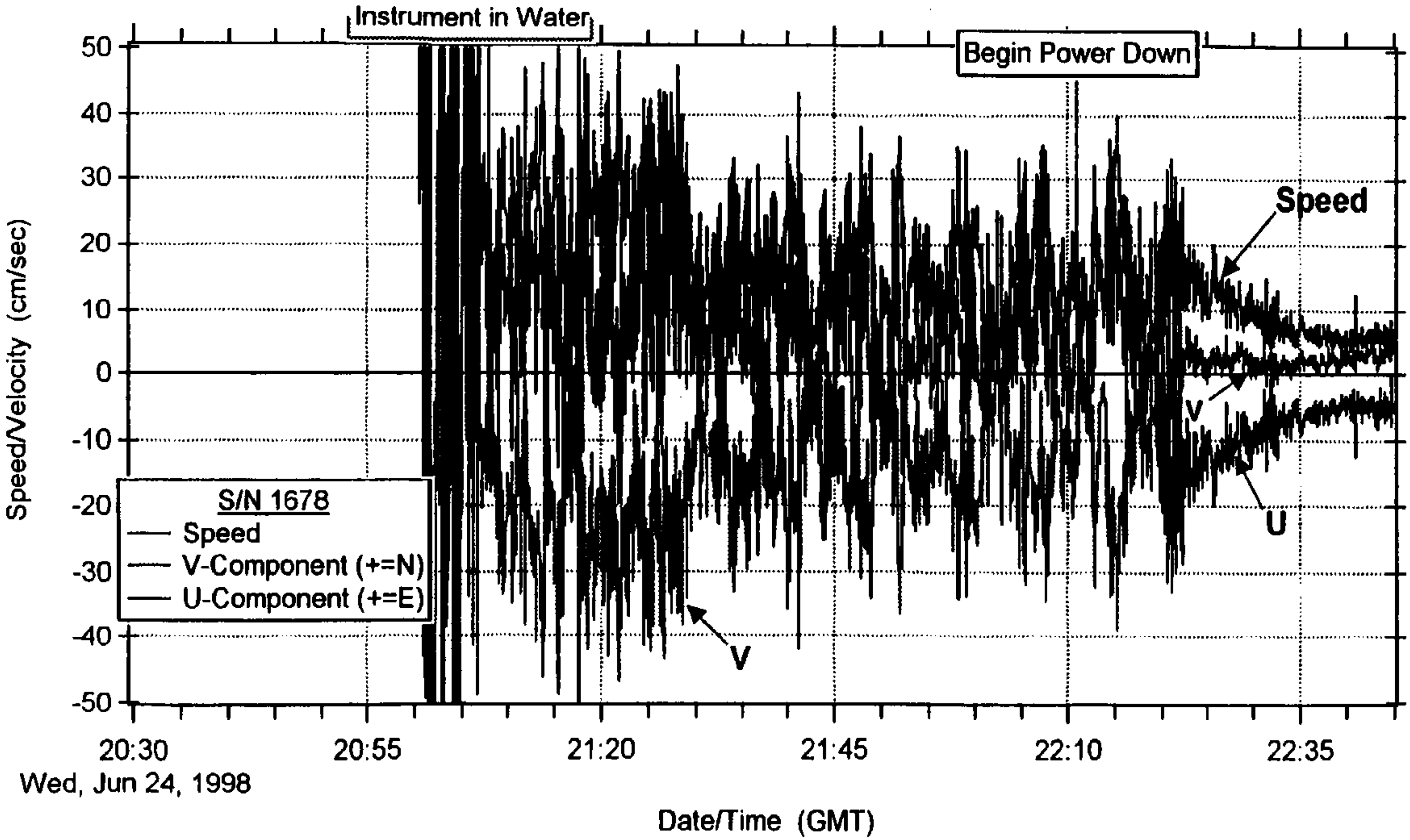

Figure 5. Data from Current Meter 1678.

PREDICTED CURRENTS

A state-of-the-art computational fluid dynamics model of the three dimensional turbulent flow field generated by a propeller having the characteristics and placement in the water column as the Navy tug was used to generate predictions of current velocity and turbulent kinetic energy for propeller RPM settings of 50, 100, and 150 at low tide with water depth 42 feet, and at 150 RPM at a high tide with water depth of 52 feet. Descriptions of the model and its predictions are discussed in detail in Jones and Korpus (1998). Only a few cases were considered because the model runs used significant super-computer resources.

Two sets of predictions were generated. At the low tide having a water depth of 42 feet, a set of simulations was generated for 90 minutes. The model was cold started at time 0 with a propeller revolution rate of 50 RPM. This rate is held constant for 30 minutes, then increased to 100 RPM for 30 minutes, then increased to 150 RPM for a final 30 minutes. The results of these computations were summarized in a group of 411 sets of data files, spaced in time roughly 22 seconds apart. Another set of simulations was generated at high tide having a water depth of 52 feet for 18 minutes. In this instance, the model was cold started with a propeller revolution rate of 150 RPM. The results of the second set of computations were summarized in a group of 67 data files, spaced in time roughly 16 seconds apart. Included in each group of data files are horizontal and vertical components of current velocity and the turbulent kinetic energy.

COMPARISONS BETWEEN MEASURED AND PREDICTED CURRENTS

Detailed comparisons between measured and predicted currents are difficult because the conditions of the field experiment were not completely known and the numerical model required simplifying assumptions. For example, the field experiment was conducted shortly after low tide when the currents in Sinclair Inlet were probably small (a few cm/sec at most). The model, however, assumed zero receiving water current speed. As noted previously, there were small variations in tugboat heading during the experiment. The model assumed a constant heading. Example comparisons between observed and predicted current velocities are provided in Jones and Korpus (1998) assuming that current velocities at equivalent times can be compared. These comparisons are often not close, but explicitly assume that each current meter location corresponds to a fixed location in the jet.

The bottom sediment resuspension rate computations to follow do not explicitly depend on the time history of the near-bottom currents, but rather on the horizontal distribution of near-bottom current shear stress raised to the 8^{th} power for a specified propeller revolution rate. Hence, the measured and predicted currents are compared in the following ways.

The current meter stations considered to be in the jet are 1851 and 1678 while the stations 1708 and 1709 are thought to be outside the jet. The following computations use the former two meters only, since the inside jet stations dominate the sediment resuspension calculations than those outside the jet. The results at the maximum propeller rate are considered the most reliable. The measured turbulent kinetic energy speeds at stations 1851 and 1678 were 13.5 cm/sec and 17.2 cm/sec, respectively, for a propeller revolution rate of 140 RPM. The currents at current meter stations labeled 1851 and 1678 were determined at 0.78 m above the seafloor using the predicted data sets computed using 42-ft depth. At each station location, the horizontal kinetic energy of the horizontal mean flow and the turbulent kinetic energy in each data set were computed, then summed, and subsequently averaged for each data set having a specific propeller revolution rate. The square root of the results was then computed to produce estimates of a predicted "turbulent kinetic energy" current speed. The predicted turbulent kinetic energy speed at stations 1851 and 1678 were 10.9 cm/sec and 15.0 cm/sec, respectively, for a propeller revolution rate of 150 RPM.

These predicted and measured speeds are compared corresponding to the propeller revolution rate of 140 RPM. The predicted turbulent kinetic energy speed is considered to depend on RPM raised to a power (i.e., speed proportional to RPM^n, where n is a constant). This constant is determined using the maximum predicted horizontal current speed and is 0.9 approximately. This relation is used to convert the predicted kinetic energy speed at 150 RPM to the predicted kinetic energy speed at 140 RPM by multiplying the 150 RPM speeds by 0.94 [i.e., $(140/150)^{.9}$]. Therefore, the predicted kinetic current speeds are 10.3 cm/sec and 14.1 cm/sec, respectively, at a propeller revolution rate of 140 RPM.

The ratio of measured to predicted turbulent kinetic energy speed at each of the stations labeled 1851 and 1678 is computed to be 1.3 and 1.2, respectively. The average of these ratios is 1.25, say 1.2. In the sediment resuspension computations to follow, predicted current velocities and turbulent kinetic energies were multiplied by 1.2 and 1.44, respectively, to obtain "real" velocities and energies.

SEDIMENT RESUSPENSION

The resuspension rate of bottom sediments near the shore of the PSNS is estimated using standard procedures. Grain size analyses of these sediments by McLaren (1998) indicate that these sediments are muds with grain diameters less than 55 μm. The current speeds at depth are relatively small and the seafloor is hydraulically smooth (Sleath 1984). An analysis of bottom roughness computed for the recent PSNS Operable Unit B RI/FS indicated that the roughness is about 5 mm and that, using a formula derived for the RI/FS, that the shear speed is approximately 0.043 times the current speed 0.78 m above the seafloor.

An investigation by Lavelle et al. (1984) determined the resuspension rate E (gm/cm^2/sec) for Puget Sound bottom sediments. Their formula states that the erosion rate is proportional to bottom stress to the 4th power. Because bottom stress is proportional to shear velocity to the second power, and shear velocity is proportional to current speed at a fixed elevation above a hydraulically smooth seafloor, the resuspension rate is proportional to current speed to the 8th power.

Lavelle et al.'s formula, together with the calibrated current velocities computed in the previous section and the equation to compute the boundary shear stress provided by Sleath (1984), are used to determine the resuspension rate expressed in gm/m^2/min over the simulation grid area at each grid point location. These values are then numerically integrated to obtain the total mass resuspended (gm/min) for each simulation data set. The individual estimates are then averaged to obtain an average total mass resuspension rate (kg/min) for a tug operating in water depths of 52 feet (high tide). The area over which 90% of the resuspension occurs is computed and is expressed in terms of the diameter of a circle having the same area.

Docking and undocking procedures for carriers must be conducted at high tide due to depth restrictions at the sill at Rich Passage between Puget Sound and Sinclair Inlet. Therefore, for carrier operations, the ambient current speed is small (a few cm/sec) and can reasonably be set to zero. The calibrated current velocity predictions are then used unaltered. The results of the 52-ft depth calculations indicate that the average total mass resuspension rate (ATMR) is 2.1 kg/min for a propeller revolution rate of 150 RPM. Values of the ATMR for other propeller revolution rates are computed assuming that these values are proportional to $RPM^{7.2}$, a relation derived from noting that ATMR is proportional to current speed to the 8th power, and current speed in the jet is proportional to $RPM^{0.9}$; hence ATMR is proportional to $[(RPM^{0.9})^8]$.

The AOEs do not draw as much water as do the CVNs, and may be docked (or undocked) at any time of day regardless of the tide height. The ATMR was computed for high and low tide conditions having water depths of 52 and 42 feet, respectively. The ambient current speed is assumed to be zero for both tides. The ATMR was calculated to be 2.1 kg/min at high tide and 7.9 kg/min at low tide. The average of these two ATMRs is 5.0 kg/min, a value used in the following analysis of alternatives.

ANALYSIS OF ALTERNATIVES

The analysis of alternative actions uses the above average total mass resuspension rates and tug boat operation procedures to estimate the total mass resuspended by an undocking (or docking) maneuver for either a carrier or an AOE.

The procedure used to undock the USS CARL VINSON was observed on April 29, 1998 by SAIC personnel on one of the Navy tugs. Four tugs were used, two from the Navy and two from Foss. The Foss tugs were "eggbeaters" and had different propulsion systems than the Navy tugs. No hydrodynamic simulations were made of the flow field produced by these tugs, however, and in this appendix it is assumed (without foundation) that the average total mass of sediment resuspended by such a tug is the same as the corresponding rate for Navy tugs. One Navy and one Foss tug pushed against the side of the USS CARL VINSON for about 20 minutes while the mooring lines of the carrier were removed. During this time, the Navy tug operated at about 65 RPM. These same two tugs then pulled the carrier away from the dock. This operation took less than 3 minutes with the Navy tug operating at 90 to 110 RPM. The carrier was then pushed toward the center of Sinclair Inlet and then turned 90 degrees so that the bow of the carrier was pointed toward the east, i.e., out of the inlet. The Navy tug operated at 100-110 RPM while pushing and at 150 RPM during the turning maneuver. The total time for this operation took less than 5 minutes, with roughly 3 minutes of pushing and 2 minutes of turning. The Navy tug operated between 50 and 100 RPM while removing lines from the tug to the carrier. Four tugs were used during pushing (pulling) and two tugs were used during the turning maneuver. The tugs then accelerated with the carrier from zero speed to about 10 knots at Pier 8.

The total mass of bottom sediments resuspended by such a maneuver is then computed by adding the resuspended mass due to 40 minutes of tug operation at 65 RPM, 6 minutes of tug operation at 100 RPM, 12 minutes of tug operation at 110 RPM, and 4 minutes of tug operation at 150 RPM. It should be emphasized that the tug operations at 150 RPM were well away from the pier in water deeper than in the immediate vicinity of the pier.

The average total mass of bottom sediment resuspended during a CVN docking maneuver is then computed as

$$2.1 \text{ kg } [40\,(65/150)^{7.2}+6\,(100/150)^{7.2}+12\,(110/150)^{7.2}+4\,(150/150)^{7.2}] = 12 \text{ kg}$$

In the calculations to follow, an AOE docking or undocking maneuver is assumed to be one-half that of a CVN because a CVN maneuver requires four tugs while an AOE requires only two tugs. The total mass of bottom sediment resuspended during an "average" AOE docking maneuver is computed as

$$5.0\ \text{kg}\ [40\ (65/150)^{7.2}+6\ (100/150)^{7.2}+12\ (110/150)^{7.2}+4\ (150/150)^{7.2}]/2 = 14\ \text{kg}.$$

During the last several years (i.e., from 1996 through 1998), ship movements within PSNS for the USS CARL VINSON (the one CVN presently homeported at PSNS) averaged 1.2 movements per month. Movements for the four AOEs presently homeported at PSNS averaged 1.7 movements per AOE per month.

Six alternative actions are considered for home ports within the U.S. Pacific Fleet. As discussed in greater detail in section 2.4 of this EIS, at PSNS these are:

Alternative 1 — one additional CVN and removal of 4 AOEs

Alternative 2 — no additional CVN or AOE

Alternative 3 — no additional CVN or AOE

Alternative 4 — no additional CVN or AOE

Alternative 5 — one additional CVN and removal of two AOEs

Alternative 6 — one additional CVN (the no action alternative).

At present, one CVN and four AOEs are homeported at PSNS. Based on estimates of the total mass of resuspended bottom sediments discussed above for CVNs and AOEs, then total mass of resuspended bottom sediments during a month totals 1.2(12)+4(1.7)(14) = 110 kg.

The adoption of Alternative 1 will result in the addition one CVN and removal of the four AOEs. The total mass of resuspended bottom sediments during a month then totals 2(1.2)(12) = 29 kg. This would reduce by 74 percent the sediment resuspension in Sinclair Inlet due to present CVN and AOE operations.

Alternatives 2, 3, and 4 would result in no change in expected sediment resuspension.

The adoption of Alternative 5 will result in the addition of one CVN and the removal of two AOEs. The total mass of resuspended bottom sediments during a month then totals 2(1.2)(12)+2(1.7)(14) = 76 kg. This would reduce by 31 percent the sediment resuspension in Sinclair Inlet due to present CVN and AOE operations.

The calculations suggest that Alternative 6 would result in the addition of one CVN. The total mass of resuspended bottom sediments during a month then totals 2(1.2)(12)+4(1.7)(14) = 124 kg. This would increase by 13 percent the sediment resuspension in Sinclair Inlet due to present CVN and AOE operations.

REFERENCES

Lavelle, J.W., H.O. Mofjeld, and E.T. Baker. 1984. *Journal of Geophysical Research* 89(4): 6543-6552.

McLaren, Patrick. 1998. A Sediment Trend Analysis (STA) of Sinclair Inlet/Port Orchard. Prepared for URS Greiner Inc.

Sleath, J.F.A. 1984. *Sea Bed Mechanics*. New York: John Wiley and Sons.

Propeller Induced Harbor Flows Modeled by Unsteady Reynolds-Averaged Navier-Stokes Techniques

Final Report
on Flow Simulation to Support
SAIC's Puget Sound Naval Shipyard
Environmental Impact Statement

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Purpose

The purpose of this study was to determine if the propeller wash from a tugboat will re-suspend sediments from a harbor bottom into the water column. Solving the resuspension problem requires first that the flow along the harbor bottom be known. In the past, this flow field has been determined through a mixture of assumption and experimentation. Unfortunately, this approach relies upon the availability of experimental data and/or experience with the particular problem. Therefore a methodology that will bring a better understanding of the flow must be ascertained.

There exist various methodologies for better understanding the details of the flow problem, and some combination of experimentation and numerical modeling is probably best. Since both methods have their pros and cons, utilizing the best of each can help control cost and result in a better understanding of the flow.

The nature of a propeller-induced flow is highly viscous and dominated by vorticity. To approach the problem utilizing a computational approach, a time accurate Reynolds-Averaged Navier-Stokes (RANS) code must therefore be used. For the application studied here, the SAIC time-accurate RANS code, called the Finite-Analytic Navier-Stokes (FANS) code, was selected.

The results of the FANS simulations were used in conjunction with the experimental data available from the field measurement part of the study. First, the simulations were used *a priori* as a guide to determine the best placement for the sensors used in the experiment. Once the experiments were complete, they were then used to validate the RANS simulations. Using FANS to assist the experimentalist is a cost-effective way to gather the appropriate information that will help in determining the flow field. The experiment in turn helps validate the computational methodology. The resulting system can then predict the flow field of various other scenarios.

Due to the nature of the problem (wherein the flow field changes over time) the RANS-generated flow information must be given to the sediment transport model in a time-accurate manner. The FANS output sets must therefore be saved every few seconds, and treated as a deliverable to the scientist performing the sediment simulations. The data includes pressure, flow velocities, and turbulent kinetic energy. All information, along with computer-generated movies to depict the qualitative nature, were delivered to the SAIC division overseeing the overall study. This report documents the nature of these deliverables and also provides a comparison to the available experimental data.

The report contains a total of eight sections. The first provides a technical description of the SAIC RANS code. The second describes the problem set up, while the third provides a general qualitative description of the resulting flows. The fourth section presents a comparison to experiments from the validation study. The fifth and sixth sections provide details of the post-processing and sensitivity studies performed as part of this effort. The seventh presents data from the high-tide simulation representing the actual working condition of interest to the EIS. The report concludes with a section giving conclusions.

Theory

The time-dependent viscous flow solutions presented in this study were obtained by solving the incompressible RANS equations in conjunction with $k\varepsilon$ turbulence model. When non-dimensionalized by a characteristic length L, velocity V_0, and density ρ, the Cartesian form of these governing equations can be written as

$$U(i),_i = 0 \tag{1}$$

$$\frac{\partial U(i)}{\partial t} + U(j)U(i),_j + (p + \frac{2}{3}k),_i - \nu_t,_j S_{ij} - \left(\frac{1}{Re} + \nu_t\right)U(i),_{jj} = 0 \tag{2}$$

$$\frac{\partial k}{\partial t} + U(j)k,_j - \left(\frac{1}{Re} + \nu_t\right)k,_{jj} - P + \varepsilon = 0 \tag{3}$$

$$\frac{\partial \varepsilon}{\partial t} + U(j)\varepsilon,_j - \left(\frac{1}{Re} + \frac{\nu_t}{1.3}\right)\varepsilon,_{jj}$$

$$- \frac{\varepsilon}{k}\left[C_{\varepsilon 1}P_{sol} + C_{\varepsilon 3}P_{irr}\right] + C_{\varepsilon 2}\frac{\varepsilon^2}{k} = 0 \tag{4}$$

where $U(i)$ represents the Cartesian velocity components, p the static pressure, k the turbulent kinetic energy, ε the rate of dissipation of turbulent kinetic energy, t the time. The quantity ν_t is defined as the linear eddy viscosity $0.09k^2/\varepsilon$, S_{ij} as the mean strain rate tensor $U(i),_j + U(j),_i$, and the Reynolds number (Re) as $LV\rho/\nu$. The rate of production of k is represented by P, and the ε equation has been split into solenoidal and irrotational components (P_{sol} and P_{irr}, respectively) following Hanjalic and Launder (1980):

$$P = P_{sol} + P_{irr} \tag{5}$$

$$P_{sol} = 4\left[S_{12}^2 + S_{13}^2 + S_{23}^2\right. \tag{6}$$

$$P_{irr} = 2\left[S_{11}^2 + S_{22}^2 + S_{33}^2\right] \tag{7}$$

The modeling coefficients ($C_{\varepsilon 1}$, $C_{\varepsilon 2}$, and $C_{\varepsilon 3}$) are taken as constants set equal to 1.44, 1.92, and 2.4, respectively.

The usual near-wall stiffness problem associated with Equation 4 has been circumvented here by using the two-layer approach of Chen and Patel (1988, 1989). The approach utilizes the $k\varepsilon$ model outlined above for most of the flow field, but a one-equation kl model in the viscous sub-layer and buffer zone. Switching between ε and l dissipation models is performed automatically when the wall Reynolds number $Re_{wall} = Re\sqrt{k\delta}$

(δ being the normal distance to the closest wall) becomes less than 300 (Chen and Korpus, 1993). Details of the l dissipation model can be found in Chen and Patel (1989) and will not be repeated here.

Discretization of the governing equations for $U(1)$, $U(2)$, $U(3)$, k, and ε is performed using the finite-analytic method of Chen, Patel, and Ju (1990). Each equation is first written in the form of a general convection/diffusion equation. Using ϕ to represent one of the conserved quantities, the generic form becomes:

$$\frac{\partial\phi}{\partial t} + U(j)\phi_{,j} - \left(\frac{1}{\mathrm{Re}} + \frac{\nu_t}{\sigma_\phi}\right)\phi_{,jj} + S_\phi = 0 \tag{8}$$

where

$$S_{U(i)} = \left(p + \frac{2}{3}k\right)_{,i} - \nu_{t,j}S_{ij}$$

$$S = -P + \varepsilon$$

$$S_\varepsilon = -\frac{\varepsilon}{k}\left[C_{\varepsilon 1}P_{sol} + C_{\varepsilon 3}P_{irr}\right] + C_{\varepsilon 2}\frac{\varepsilon^2}{k}$$

and $\sigma_\phi = 1$ unless $\phi = \varepsilon$, in which case it is set to 1.3, (σ_ϕ is a model coefficient).

In the interest of making the RANS solver sufficiently general for arbitrary geometries, the independent variables of the governing equations are first transformed into body-fitted coordinates. Using (ξ^1, ξ^2, ξ^3) to represent a generally non-orthogonal curvilinear system, Equation 8 becomes:

$$\frac{\partial\phi}{\partial t} + \left[(U(j) - V(j)_{grid})\xi^k_{,j} + \left(\frac{1}{\mathrm{Re}} + \frac{\nu_t}{\sigma_\phi}\right)f^k\right]\frac{\partial\phi}{\partial\xi^k}$$

$$+\left(\frac{1}{\mathrm{Re}} + \frac{\nu_t}{\sigma_\phi}\right)g^{jj}\frac{\partial^2\phi}{\partial\xi^j\partial\xi^j}$$

$$+\left[S_\phi + \left(\frac{1}{\mathrm{Re}} + \frac{\nu_t}{\sigma_\phi}\right)\sum_{i\neq j} g^{ij}\frac{\partial^2\phi}{\partial\xi^i\partial\xi^j}\right] = 0 \tag{9}$$

where g^{ij} is the contravariant fundamental metric tensor $f^k = \nabla^2\xi^k$, and $\xi^k_{,j}$ is the inverse of the covariant transformation tensor $\partial x^k/\partial\xi^j$. The extra convective term $V(i)_{grid}$ represents a Cartesian grid point velocity arising from the time derivatives in a moving coordinate system and has been included to allow arbitrary grid movement. Note that the cross-derivative terms from the Laplacian in curvilinear coordinates were lumped with the source term to preserve a form amenable to separation of variables, and that the

Schwarz-Christoffel terms (f^k) were lumped with the convective velocities to speed convergence.

With the equations in their generic form, the discretization proceeds by linearizing Equation 9 over each computational element, and then solving analytically by separation of variables. Evaluation of the analytic solution at the interior node of a computational element provides a stencil for the center point in terms of its nearest neighbors. Time derivatives are handled by the Euler implicit method, and unknowns from the previous time step are lumped into the source term. The resulting implicit system of equations is solved by the Alternating Direction Implicit (ADI) method in each cross flow plane, and then swept repetitively in the streamwise direction. Detailed expressions for the coefficients of the finite-analytic stencil can be found in Chen, Patel, and Ju (1990).

Pressure coupling is supplied using a modified SIMPLER/PISO algorithm (Chen and Patel, 1989) that uses the strong conservation form of Equation 1:

$$\frac{1}{\sqrt{g}}\left(\sqrt{g}U^i\right)_{,i} = 0 \tag{10}$$

where U^i is the contravariant $U(j)\xi^k_{,j}$ and g is the determinant of the covariant fundamental metric tensor. The technique defines pseudo-velocities from the discretized form of Equation 9 as:

$$U^i = \hat{U}^i + E^{ii}\frac{\partial p}{\partial \xi^i} \tag{11}$$

where $\hat{U}^i$ and E^{ii} necessarily involve the finite-analytic coefficients, and will not be repeated here (see Chen and Korpus, 1993). The technique is unique in that it introduces pseudo-velocities at the staggered grid locations, thereby leaving the pressure unknowns at the grid nodes. A discrete pressure Poisson equation is obtained using central differences, and then substituting Equation 11 into 10:

$$\begin{aligned}
&\left(\sqrt{g}E^{11}\right)_{i+1/2}\Delta^i p - \left(\sqrt{g}E^{11}\right)_{i-1/2}\Delta^i p \\
&+ \left(\sqrt{g}E^{22}\right)_{j+1/2}\Delta^j p - \left(\sqrt{g}E^{22}\right)_{j-1/2}\Delta^j p \\
&+ \left(\sqrt{g}E^{33}\right)_{k+1/2}\Delta^k p - \left(\sqrt{g}E^{33}\right)_{k-1/2}\Delta^k p \\
&= -\left(\sqrt{g}\hat{U}^1\right)_{i+1/2} + \left(\sqrt{g}\hat{U}^1\right)_{i-1/2} \\
&-\left(\sqrt{g}\hat{U}^2\right)_{j+1/2} + \left(\sqrt{g}\hat{U}^2\right)_{j-1/2} \\
&-\left(\sqrt{g}\hat{U}^3\right)_{k+1/2} + \left(\sqrt{g}\hat{U}^3\right)_{k-1/2} .
\end{aligned} \tag{12}$$

Note that subscripts on the $\vec{U}^i$ and E^{ii} terms now represent discrete (staggered) grid locations, and Δ^i and ∇^i represent forward and backward difference operators in the direction of the superscripted index.

For calculations around complex or moving geometries, the discrete solvers resulting from Equations 9 and 12 are embedded in a Chimera-like, multi-block environment. The solver works on one block at a time, and the only grid connectivity requirement is that the union of blocks spans the entire computational domain. Individual blocks are allowed to overlap arbitrarily, and inter-block communication is handled by conservative tri-quadratic interpolation. The overall approach has been extensively validated for both steady and unsteady three-dimensional applications (Korpus, 1995, Chen and Korpus, 1993, Weems and Korpus, 1994).

Setup

Many assumptions were made to make these calculations possible. It was first assumed that harbor could be represented using a flat bottom and "rigid lid" free surface condition. It was also assumed that the tug propeller could be represented using a body force approach that models a propeller's effects as "smeared" through 360 degrees. Representing the forces in this way saves significant grid points, and therefore computer resources, but sacrifices some detail since the individual tip vortices will appear as a circumferentially uniform vortex tube. It was also assumed that tidal and other environmental effects could be neglected, and that the simulations would all begin from quiescent flow. The tugboat hull and rudder are neglected; as it turns out, inclusion of the rudder may have been important because of the extra vorticity it would introduce. Finally, the tug's motion was neglected, even though it was observed to move somewhat during the test.

Grid generation for this problem consisted of a Cartesian cell structure with three blocks overall. The first block defined the location of the propeller, and contains a high density of points to adequately resolve the initial propeller flow. The second block designated as the wake block resolves the characteristics of the wake and helps carry the flow to the third block. Normally the resolution of this block is approximately half of the propeller block's resolution to ensure adequate flow characteristics. The third block, known as the far field block, contains resolution similar to that of the wake block near the overlapping regions but approximately 10 times that cell size at the far field boundaries. The use of a preprocessor allowed the computational cells in the fine blocks to take precedence over those in the coarse blocks. The grid is depicted in Figures 1a and 1b.

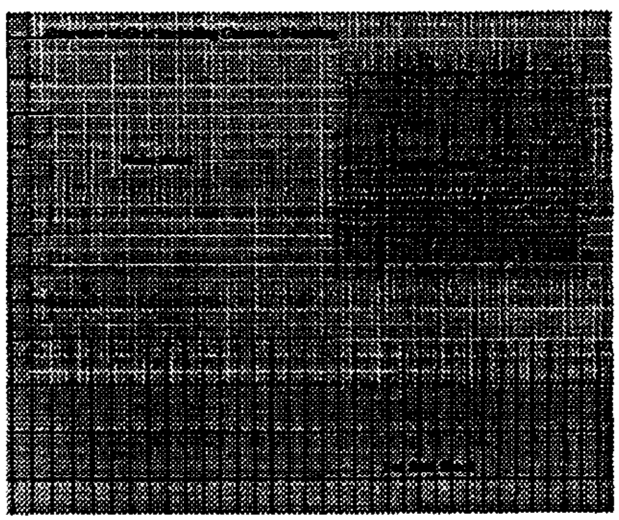

Figure 1a

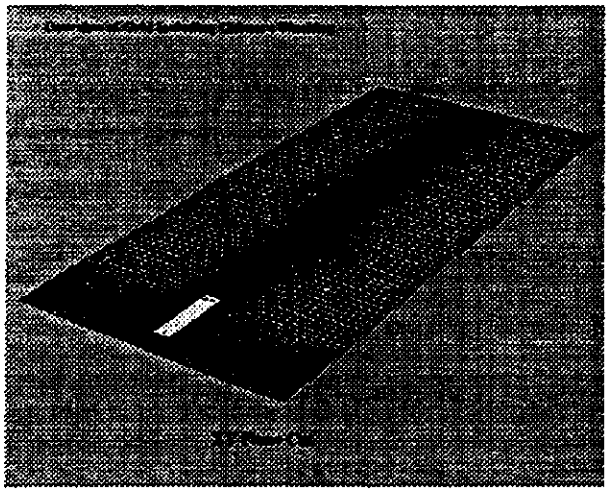

Figure 1b

The ultimate size of the far-field block was chosen by performing a sensitivity study using different sized grids. Five grids of different extent were developed, and sample runs were made on each to quantify the effects of the far-field boundaries on the near-field flow. Table 1 indicates the different studies that were conducted. The studies indicated that, due to the long run times required for comparison to the field experiment, only the longest and widest domain was able to keep the boundaries from affecting the near-field solution.

Table 1

42 foot depth	Narrow	Wide
Short	~640,000 pts	~680,000 pts
Medium		~740,000 pts
Long	~820,000 pts	~850,000 pts

A second sensitivity study was then performed to determine an allowable time step for temporal resolution. The usual FANS code time step of 0.05 was thought to be too small due to the large simulation lengths required; it would have taken 96,000 iterations to acquire 30 minutes of real time data for comparison to the full-scale experiments. A brief study on the stability of the computation demonstrated that the non-dimensional time step of 0.15 could be used. Increasing the non-dimensional time step to 0.15 allowed for 90 minutes of real time data to be run in fewer than 81,000 iterations, which on the CRAY T90 took approximately 12 days.

Setup for the first FANS run was chosen to model that of the experiment. The non-dimensional time step for this particular run was set at 0.15 and the harbor depth was set at a low tide measurement of 42 feet. The body force propeller was run first at 50 RPM for 30 minutes real time; the body force representation was then increased to 100 RPM for another 30 minutes of real time, followed once again by an increase to 140 RPM for a final 30 minutes of real time. Once completed, the simulation data was compared to the experimental measurements for validation purposes. This comparison will be detailed further in the Analysis section below.

Following the 42-foot deep study, a similar simulation was performed to detail the flow field at 52 feet deep. The non-dimensional time step was once again set at 0.15, and the computational domain was similar to that of the 42-foot computation. The body force representation was run at 150 RPM from the beginning of the experiment. All other previous assumptions held true in this computation.

Setup for the 42-foot and 52-foot depth simulations was completed using the following non-dimensionalization values:

- U_∞ was always defined as tip speed at 150 RPM, or 94.25 ft/sec
- L was always defined as depth, which is the characteristic length.
- $K_T = \frac{Thrust}{\rho n^2 D^4} = 0.2$ (Thrust coefficient)
- $K_q = \frac{Torque}{\rho n^2 D^5} = 0.22$ (Torque coefficient)
- $J \equiv \frac{U_\infty}{nD} = \pi \frac{n_{ref}}{n} = 9.42$, 4.7123, and 3.3659 for 50, 100, and 140 RPM respectively (J is defined as the advance ratio, n_{ref} the characteristic RPM, 150 RPM, n the RPM for the case that is being run.)
- Reynolds number was always $\frac{LU_\infty}{\nu} = 305*10^6$ for the 42-foot case and $377*10^6$ for the 52-foot case.
- Dimensionalizing for u, v, and w was always $U_\infty = 94.25$ ft/sec
- Dimensionalizing for time was always $\frac{L}{U_\infty} = 0.446$ for the 42-foot case and 0.552 for the 52-foot case.

Analysis

Three types of studies were performed to support the Sediment Transport Model:

- Sensitivity analysis to identify the best extent for the computational domain
- Comparison to Experiment cases to provide validation
- Actual tug operating case of 52-foot depth and 150 RPM.

The first class of studies consisted of a series of runs that varied domain width and length. These parameters were varied until it was determined that the boundaries no longer affected the flow solution. This study concluded that the domain had to be at least 46 depths long and 20 depths wide.

The second study simulated the experiment performed using an actual Navy tugboat pushing on one of Shipyard's piers. This simulation, like the experiment, consisted of running the model at a 42-foot depth, with consecutive prop speeds of 50, 100, and 140 RPM for 30 minutes each. Comparison of the computed results are presented in the next section.

The third study depicted the 52-foot depth (high tide) operating case, representing the tug working to berth an aircraft carrier.

Figures 2a and 2b give a qualitative idea of how the propeller wake develops for any one case. Each figure depicts the x component of vorticity, where the solid blue shape represents a negative value and the pink represents a positive x value. It is interesting to note that propeller wake vorticity splits, with the positive and negative portions migrating in different directions. The free surface appears to affect the vorticity by flattening it out as it migrates away from the propeller. Further downstream, the vorticity begins to migrate off the surface. As time passes, the vortices actually turn vertical and intersect the bottom of the harbor.

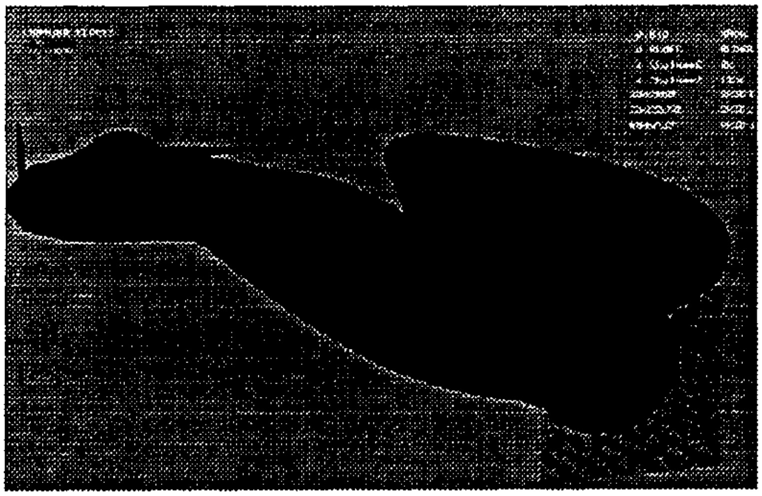

Figure 2a

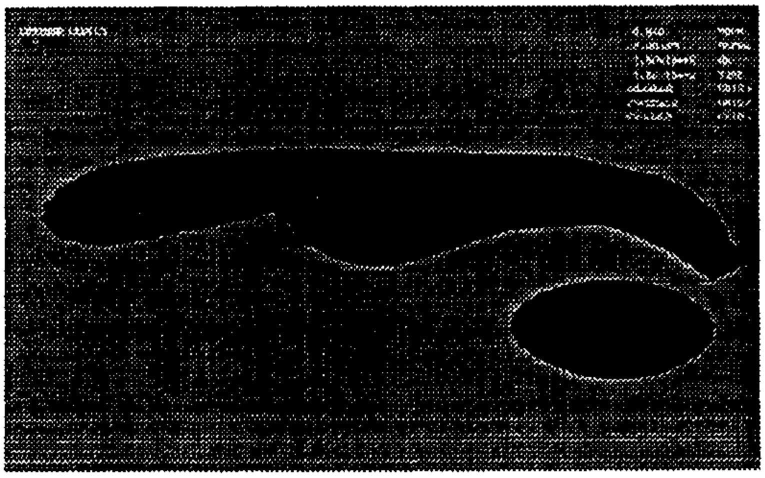

Figure 2b

Comparison to Experiment - Qualitative Analysis

The findings from the initial comparison computation are shown in Figures 3, 4, and 5. The figures represent the flow field in a 42-foot deep harbor, at a depth of 0.7802 meters above the bottom. The snapshots in time represent 15.02 minutes, 45.06 minutes, and 75.1 minutes into the simulation, respectively. Velocities are shown in cm/s and turbulent kinetic energies in cm^2/sec^2. The 'a' part of each figure shows velocity vectors colored by velocity magnitude, and the 'b' part of each figure shows color contours of turbulent kinetic energy.

The figures represent a partial look at the computational domain, with the quay wall shown to the left side of the figure and the propeller lying approximately 6.5 grid cells from the left side of the grid and in the center. The compass directions correspond to the experiment, with the left side of the figure being North (upstream) and the top of the figure being East (starboard). The computational domain in each calculation extends much further downstream and to either side, with the overall dimensions of the grid being 840 x 1848 feet (or 256 x 563 meters). In order to compare the velocities and turbulent kinetic energy, the figures represent the exact same space and location within the domain. A background grid of 500 x 500 centimeters was added for reference, and the black symbols (large plus signs) on Figures 3a, 4a, and 5a represent the approximate locations of the sensors whereas the black box is the approximate location of the propeller.

Qualitatively, there are many observations that may be made from Figures 3, 4, and 5. The more observable changes in patterns and trends appear to be with the magnitude of velocity figures, which will be referred to as Figures 3a, 4a, and 5a.. In Figure 3a, the flow is in the initial stage of development and is only half-way through the 50 RPM portion of the test. The largest velocity magnitudes appear in the propeller race and to either side where large vortices are starting to form. The developing vortices are of opposite rotation. Note that higher velocities and energies are developing on the starboard side of the grid first, and that the vorticity there appears to be stronger. This trend is followed for most of the flow patterns seen throughout the computation. Figure 3b, which shows the turbulent kinetic energy, indicates that the most turbulent area is developing just beyond the hot spot in the propeller race.

Figure 4a represents a time of 45.06 minutes, or about half-way through the 100 RPM portion of the test. It shows that, as the vortices move downstream, the outer bands of the vortex converge in the center of the figure. This interaction causes an increase in velocity.

Figure 5a represents a time of 75.1 minutes, or approximately half-way through the 140 RPM segment. It shows that the velocity magnitudes have now increased by approximately 3 times, and that the turbulent kinetic energy has increased 8 times over that seen at 50 RPM. The highest velocities and turbulent kinetic energy appear to be in the center of the two vortices. Also note that the center of the two vortices does not lie down the center of the figure, but just to starboard of the propeller centerline.

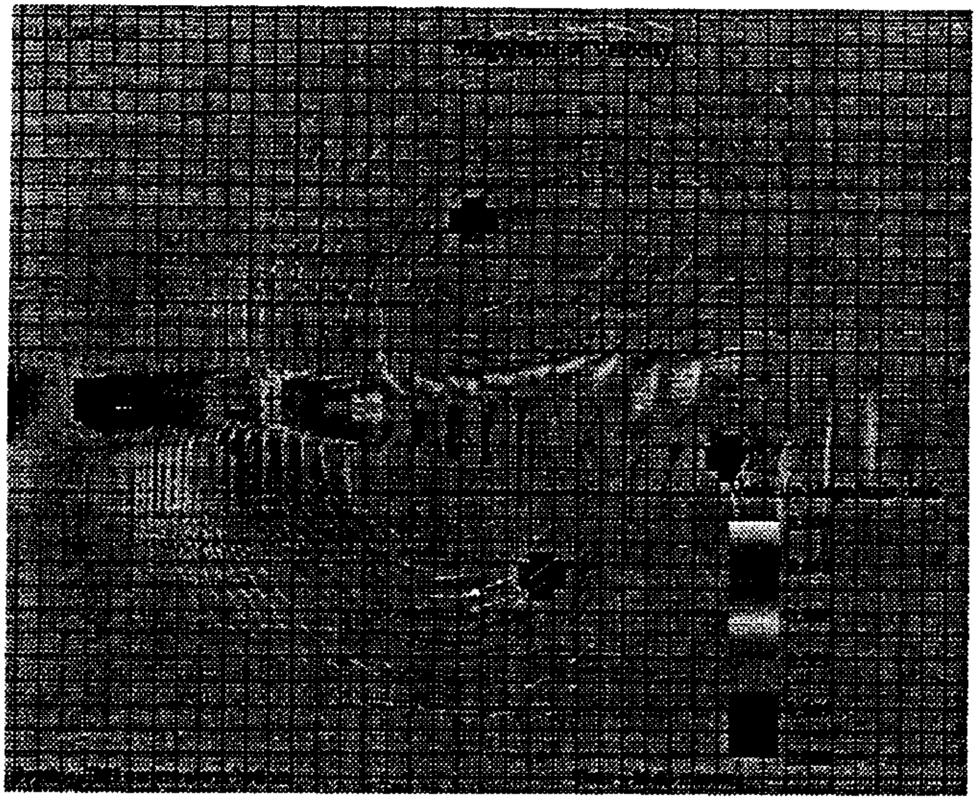

Figure 3a

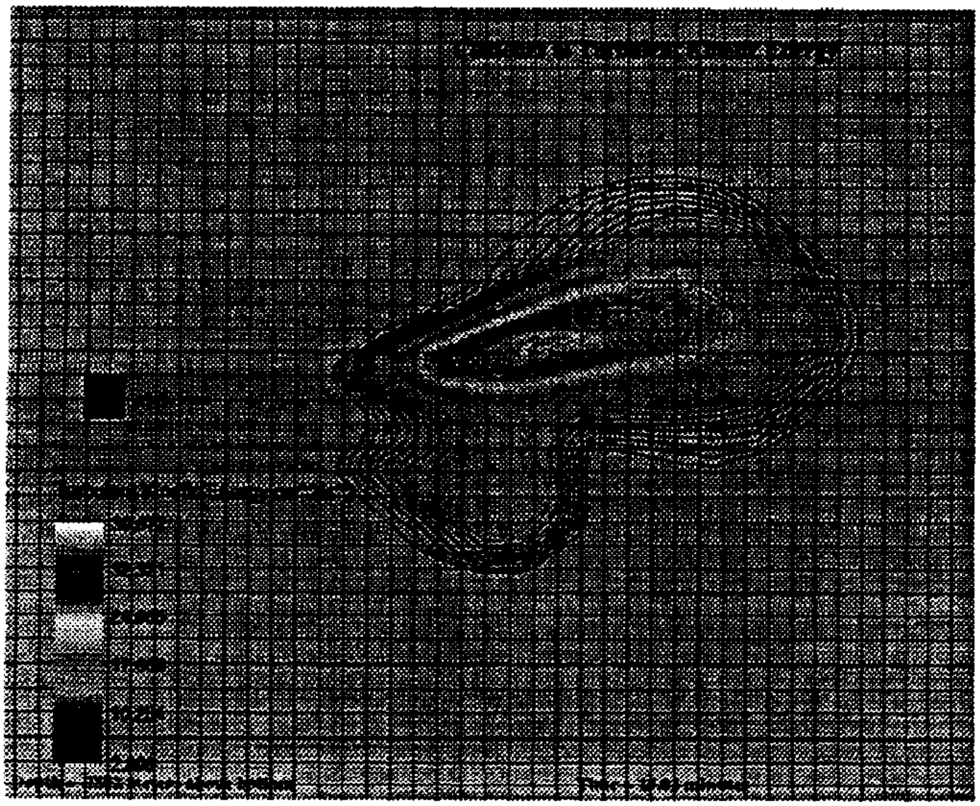

Figure 3b

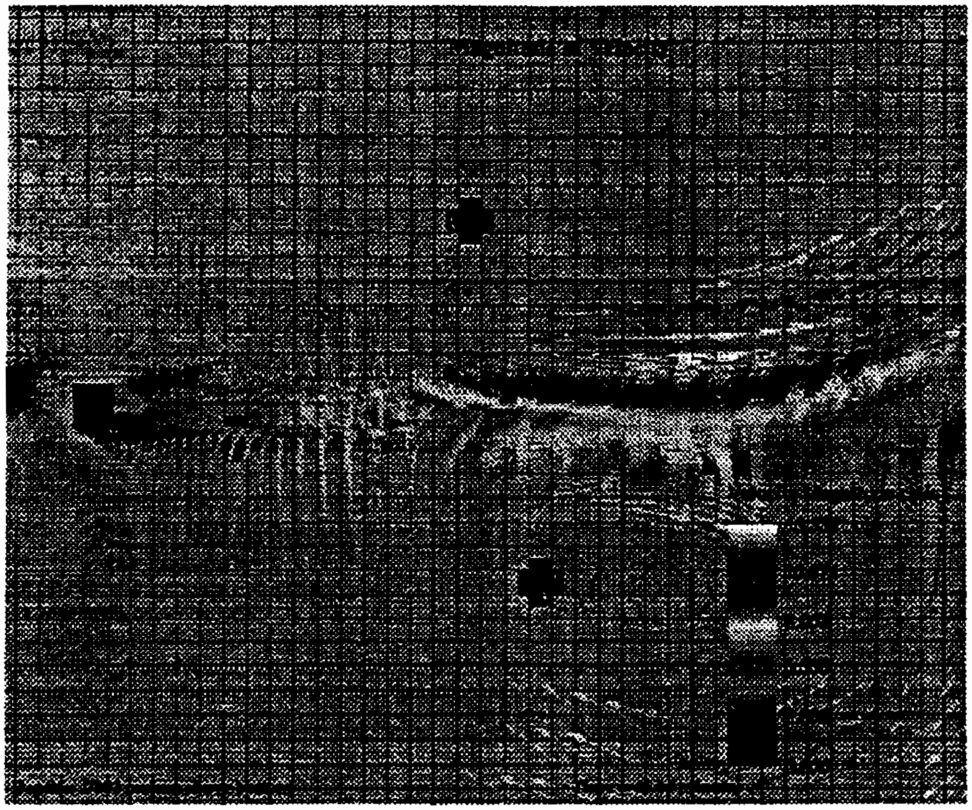

Figure 4a

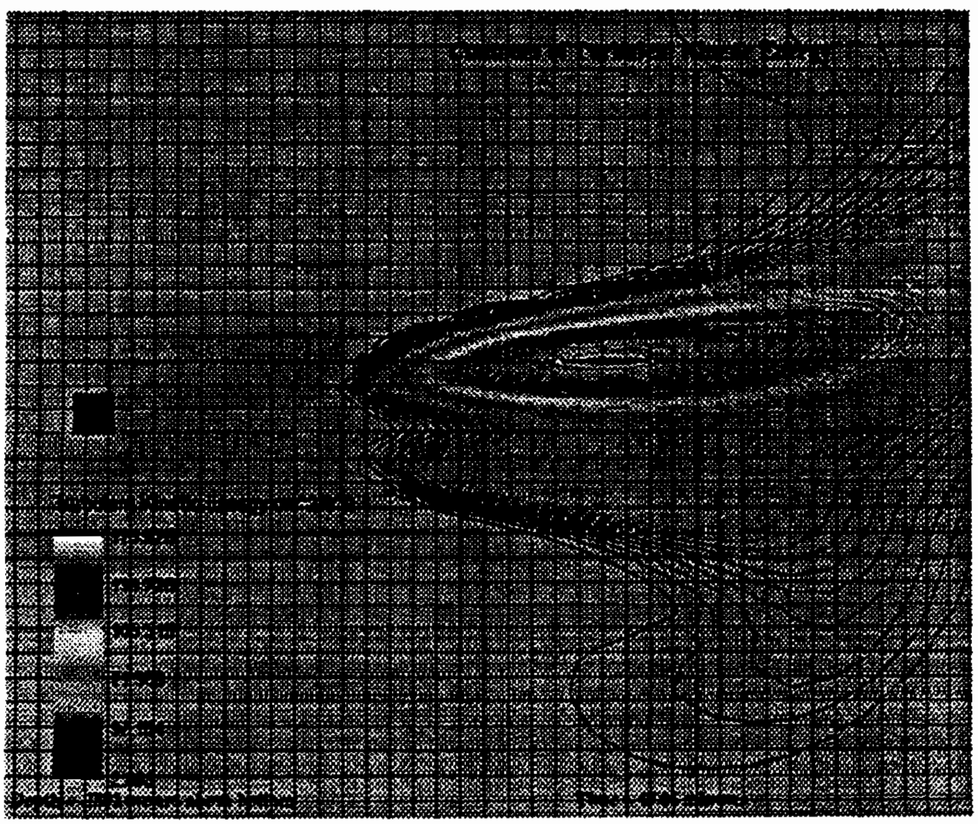

Figure 4b

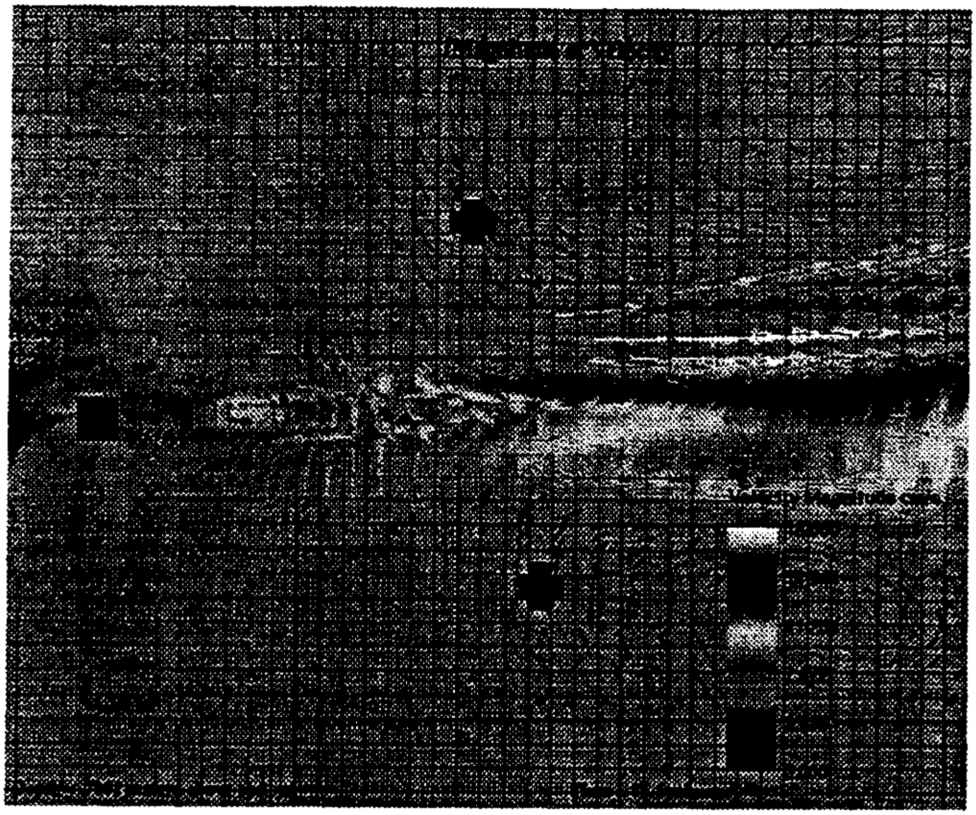

Figure 5a

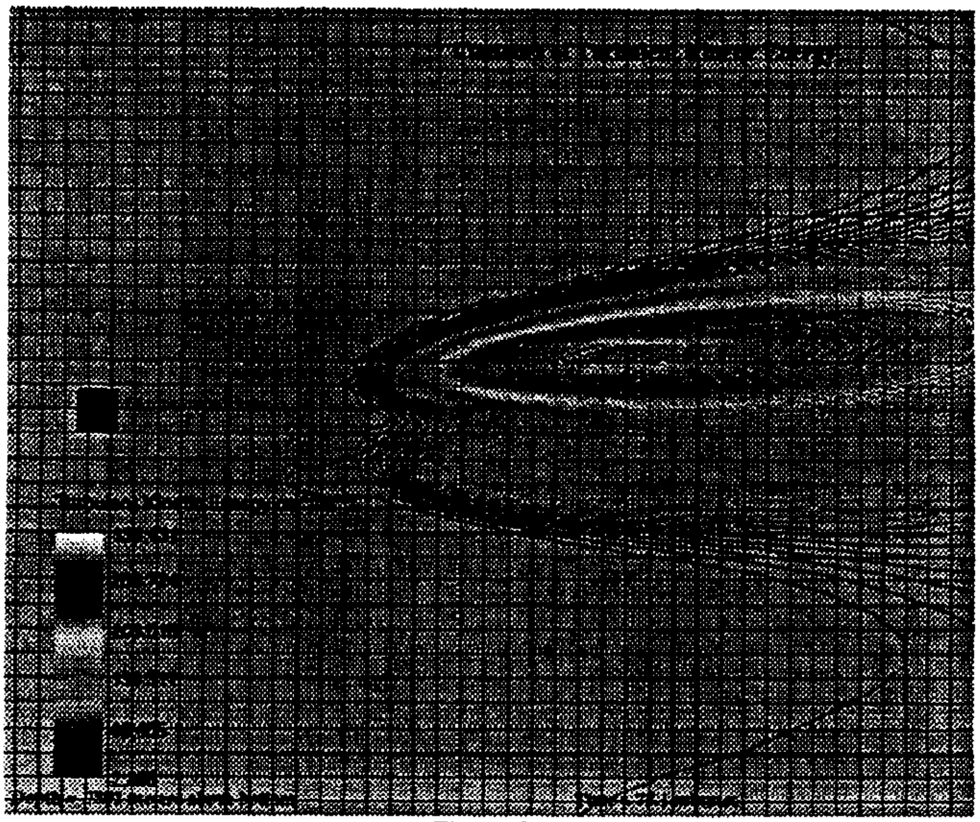

Figure 5b

Comparison to Experiment – Quantitative Analysis

Actual experimental data, taken in Sinclair Inlet on June 24^{th}, 1998, is compared to the FANS-computed results in the figures below. Sensors at four locations acquired the velocity data from the flow field. These locations are noted as flow meter numbers 1851, 1678, 1708, and 1709, which correspond to upstream, downstream, starboard, and port. Each of the figures is set up to compare the U and V velocities of FANS to that of the Experiment. The U velocities correspond to the East/West direction, with East being positive, and the V velocities correspond to the North/South direction, with North being positive. As a frame of reference, North is the direction to the quay wall and is the location of the tugboat's bow during the experiment. The comparisons exist over time for 0 to 90 minutes, corresponding to the extent of the experiment.

Figures 6, 7, 8, and 9 compare each of the meter measurements to the FANS predictions. Each figure includes the mean value of the FANS predicted velocity and also a side band made up of the standard deviation in velocity due to turbulence. The calculation of standard deviation for the FANS computation is proportional to the square root of the turbulent kinetic energy. Note that the standard deviation of the experimental measurements was not calculated but could be expected to be less than the peak-to-peak oscillations shown in the figures.

Figure 6 depicts the comparison for the sensor labeled 1851 (upstream). The sensor is located approximately 30 meters downstream from the propeller and 5 meters to port of the centerline. It can be seen that the velocity as computed from FANS is very small in both the North/South and East/West directions. The FANS calculations show that the increase in RPM at 30 and 60 minutes has only a slight effect upon the upstream sensor. The experimental values from this sensor seem to vary quite a bit, with the East/West variations being higher than the North/South.

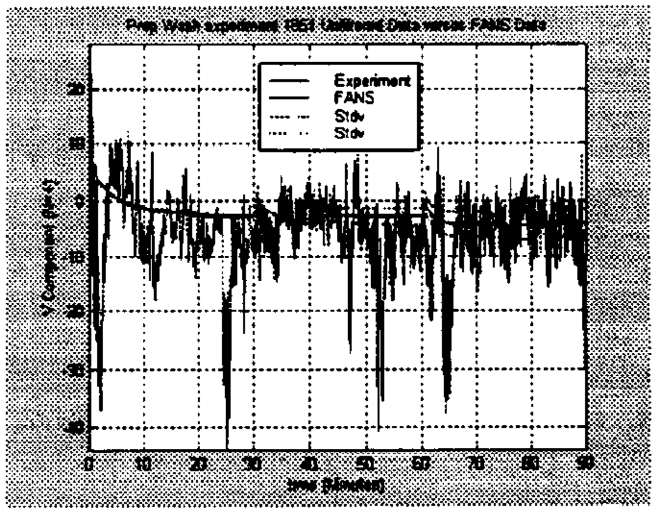

Figure 6a

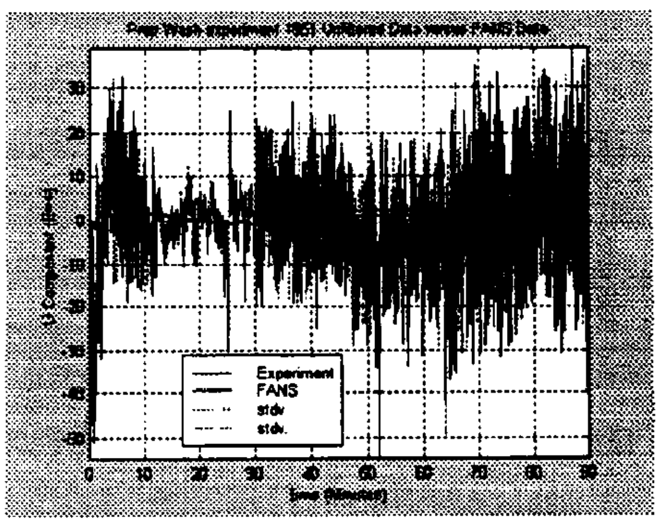

Figure 6b

Figures 7a and 7b show the downstream sensor location, located approximately 142 meters downstream and 7.5 meters off the centerline to port. The flow meter in this case did not begin acquiring data until 31 minutes after the experiment began, and then showed unrealistic oscillations until about the 40 minute mar; the figures therefore show the experimental data after 40 minutes. Both figures show that the standard deviation increases progressively in time, and that this corresponds to the large areas of high turbulent kinetic energy seen in Figures 3, 4, and 5. Figure 7a and 7b also indicate that the majority of the flow in the FANS computation is in a southerly direction or downstream. The peaks in the FANS-computed mean value for this sensor correspond to the influence of increasing the propeller's RPM. These peaks also lag about one minute beyond the increase in RPM. In the experimental runs, it is difficult to determine when the change in RPM occurred. Furthermore, the experiments also indicate that the flow is mostly southerly with some small east/west component.

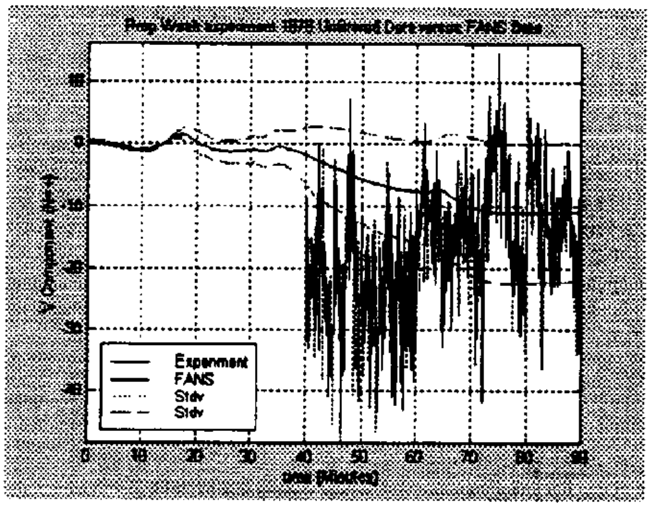

Figure 7a

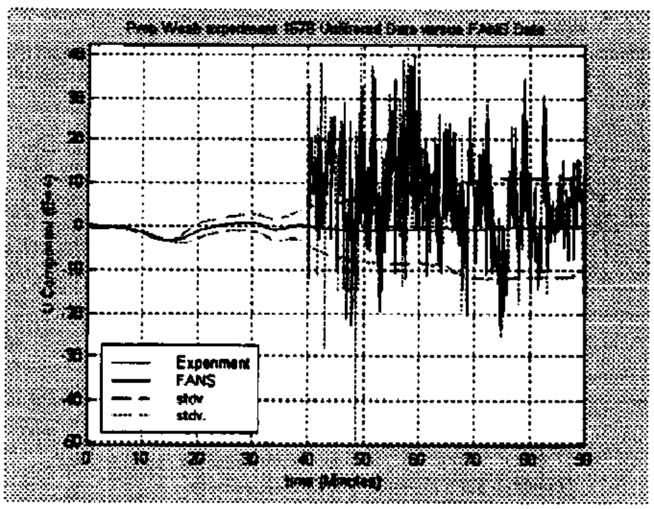

Figure 7b

Figures 8a and 8b show the starboard sensor, which was located 82.5 meters downstream and 38 meters to starboard off the centerline. The flow in the north/south direction compares fairly well with the FANS computation, but the comparison in the east/west direction is poor. The basic trend in the north/south direction, Figure 8a, is well captured by FANS up until about the 60-minute mark. Following the increase of RPM at 60 minutes, however, the increase of FANS velocity does not follow the increase seen by the sensor.

The east/west FANS results indicate that the flow has a generally east to west direction. Referring back to Figures 3, 4, and 5 from the previous section, one notices that the starboard vortex appears to pass just inside of the sensor. Observing the experimental data, it would also appear that the vortex passes inside the sensor because the north-south velocity has the same sign as the simulation. However, the magnitude of the east/west velocity is much higher, on the order of 3 to 7 times, indicating that the vortex may be significantly closer to the sensor in the experiment than in the computation.

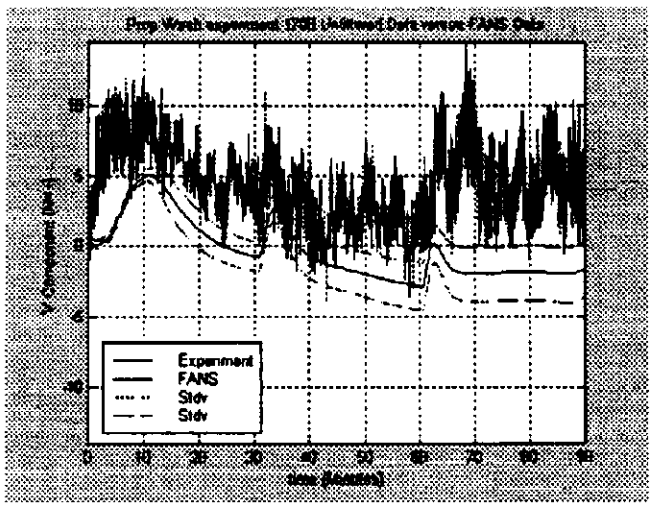

Figure 8a

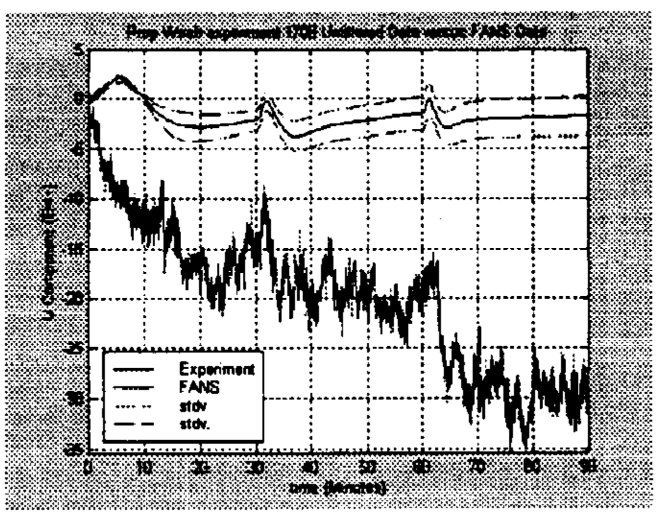

Figure 8b

Figures 9a and 9b depict the results for the port sensor, located approximately 98.5 meters downstream and 36 meters to port of the centerline. The FANS computation indicates that the flow begins in a westerly direction and then shifts to easterly. Observing the previous qualitative figures, it can again be speculated that the vortex travels on the inside of the sensor. The change in sign of the east/west velocity, however, indicates that the vortex passed over the sensor in this case. The fact that the shift takes place at a different time in the calculations indicates that the vortex had different speeds in the calculation and the experiment.

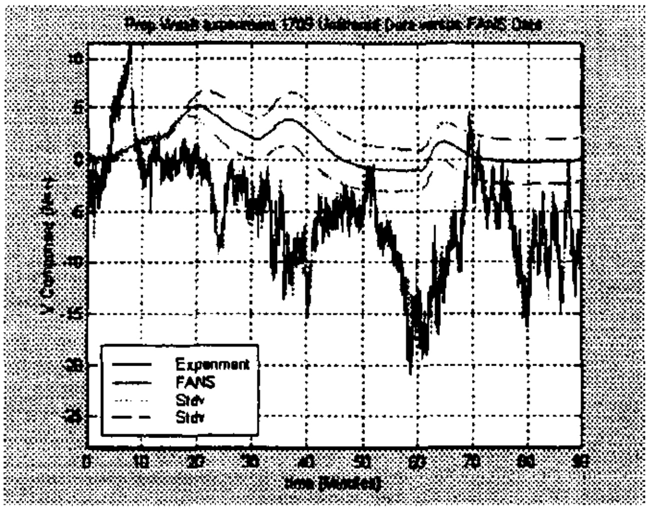

Figure 9a

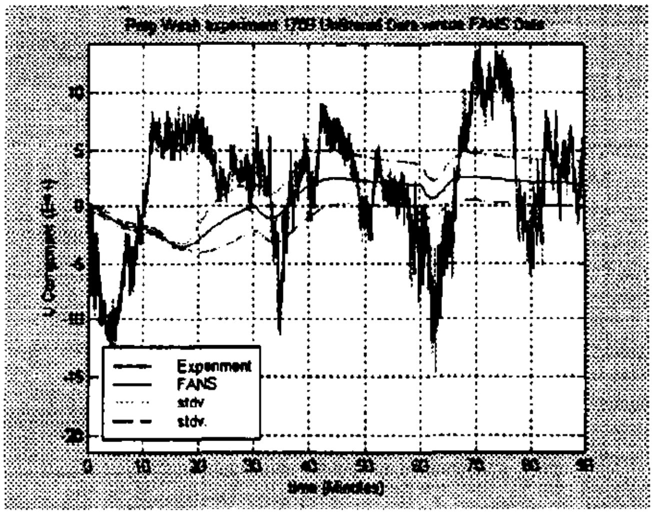

Figure 9b

After comparing the FANS computation to the experimental data, it appears that FANS did not always predict flows measured in the field test. Part of this difference, however, might be explained by some of the simplifying assumptions made during problem setup. Since the propeller was modeled using a body force representation, the individual tip vortices were not taken into account. The absence of a rudder would also cause the calculation to leave out some of the small-scale vorticity in the flow. The presence of such small vortices could explain the high-speed, high-frequency velocities seen in the experiment. The rigid lid free surface model and flat bottom approximation could also have an effect.

The conclusion is not necessarily that the computation failed, for it has shown very detailed physics that would be difficult to capture experimentally. There are also some reasons why we might suspect that the current experiments are not ideal for validation purposes. Normally the validation of codes requires a very controlled experiment (such as a wind tunnel or tank test) to remove any uncertainty in the experimental setup. The experiment conducted here took place in the actual harbor, where environmental affects (*e.g.* tides and currents) and experimental error (*e.g.* tugboat setup) are very difficult to account for.

Tugboat placement itself, for example, introduces many unknowns that could not accurately be controlled. Since its trim was not measured (it will pitch as it pushes on quay wall) the initial trajectory of the propeller wash is not known. It was also noted that the boat did yaw somewhat during the experiment and that the captain applied rudder to keep the boat lined up, but neither yaw nor helm angle was recorded. Finally, since the population of the sensors was sparse, getting a good picture of the flow pattern is difficult. Slight shifts between the experimental flow patterns and the computational assumptions could cause large differences in the predictions.

Sensitivity Study - Filtering Process

Based on these results, a sensitivity study was conducted to assess differences between the experimental and computational results. As noted during the original analysis of the sensor locations, the FANS results did not always compare well to the experimental results. Furthermore, it was noted that there existed some large variations in the experiment that needed to be examined further. Because the field test did not match all of the computation's assumptions, a sensitivity study was conducted to assess the potential effect of these differences on the results.

Before the sensitivity study, a 5^{th} order butterworth filter was applied to the data. The butterworth filter was used as a lowpass filter, filtering out the high frequency content of the data. A quick study was performed on the effect of filtering. In Figures 10a and 10b, it can be seen that the filter introduces a very small (*i.e.* 10-second) time lag into the data, as compared to 10c, which has a 4-minute time lag. The difference is the high frequency cut-off applied with the butterworth filter, which is different by an order of magnitude. However, observing the differences in the figures, it can be seen that 10c smoothes out the data very well, compared to 10a where there still exists a high frequency content. The filtering process may need additional attention to address the use of other filtering techniques to remove the high frequency content but without introducing a time lag.

In light of this observation, the higher frequency cut-off was chosen for all future studies. Figures 10a and 10b thus demonstrate the use of the 5^{th} order butterworth filter applied in this report. For the following sensitivity analysis, the filtering process was chosen so as to minimize the introduction of a time lag, while still filtering some of the high frequency content in the sensor data.

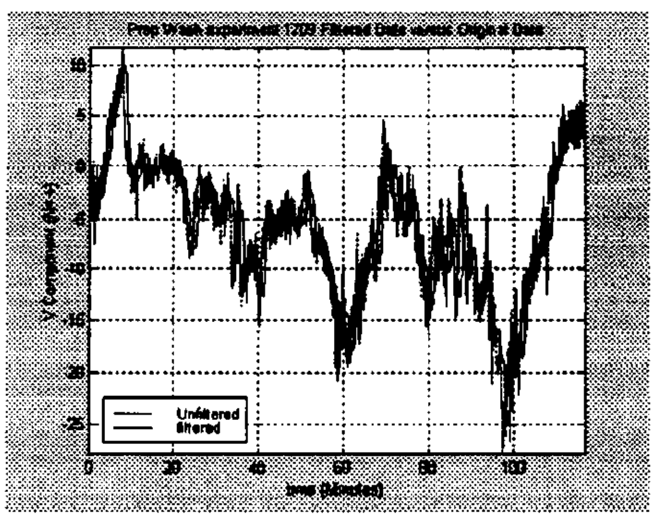

Figure 10a

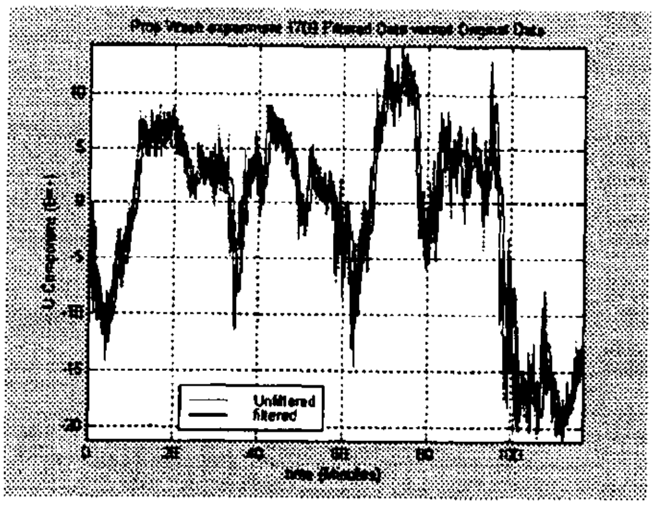

Figure 10b

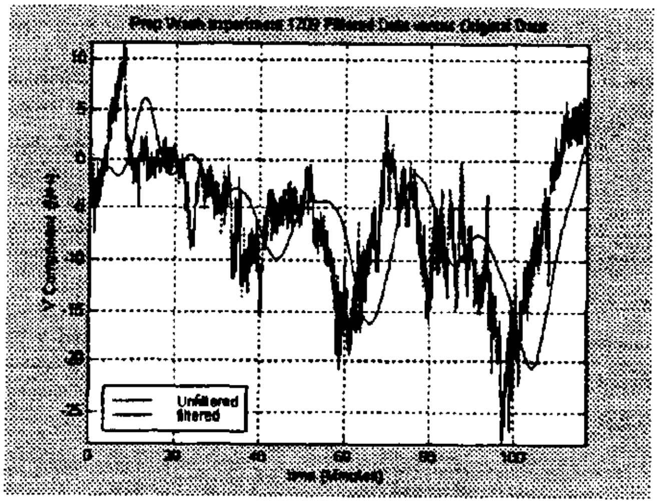

Figure 10c

One more interesting feature pertaining to experimental uncertainty can be seen in the above figures. Figure 10c, for example, shows that after the tug propeller is shut down at 90 minutes, sensor 1709 is still reading data from some unknown source. The velocity does not trend back to zero, but actually increases.

Sensitivity Study - Analysis

A sensitivity analysis was conducted to demonstrate the sensitivity of the FANS solution to the placement of the sensor. It can be seen in the following figures that the change in location affects the solution considerably. The sensitivity study was performed by interpolating time-lines of data out of the RANS solutions at a number of locations centered around the actual sensor location. The locations were chosen at positions 10 meters upstream, downstream, port, and starboard of the actual sensor location.

In the analysis, the components are generally labeled U, U1 comp, U2 comp, U3 comp, and U4 comp. Looking at sensors 1709, 1708, and 1678, U signifies the original data point that was used for the sensor location, which measure the east/west velocity component. From the original data location U, U1 lies 10 meters north, U2 lies 10 meters east, U3 lies 10 meters west, and U4 lies 10 meters south.

Furthermore, for the upstream case 1851 the configuration changes to capture differences in the North/South flow, the configuration is as follows:

- U = original location
- U1 component = U + 10 meters North + 10 meters West
- U2 component = U + 10 meters South + 10 meters East.
- U3 component = U + 10 meters South + 10 meters West.
- U4 component = U + 10 meters North + 10 meters East

The configurations for the North/South flow directions follows directly the same pattern as was just previously described.

The results are shown in the next four figures, one for each sensor. Observing sensor 1851 (Figure 11a), it can be seen that the U2 and V2 components of the sensitivity study appear to come closer to the measured trend than the other results. Thus, a 10-meter shift in the actual flow pattern as compared to the computational result (due to a current, for example) would be sufficient to considerably improve the comparison.

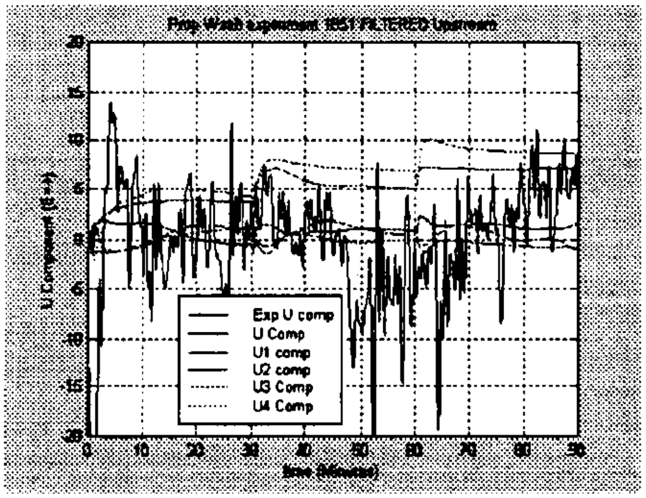

Figure 11a

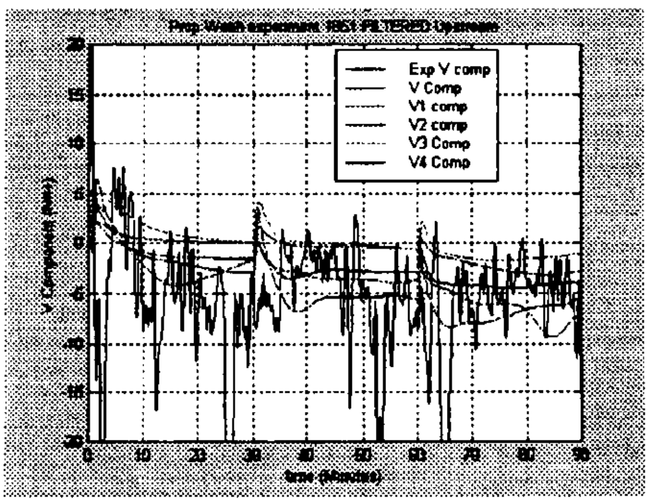

Figure 11b

In the downstream sensor case, it can be observed that none of the sensitivity study results compares well with the east/west flow in Figure 12a. The more southerly flow shown in Figure 12b appears to be trending in the right direction, but the sensitivity analysis shows that the magnitude of the computation still is 50 percent off up to 70 minutes. After 70 minutes, the solutions in the experiment and computation appear to follow the trend of the V2 component.

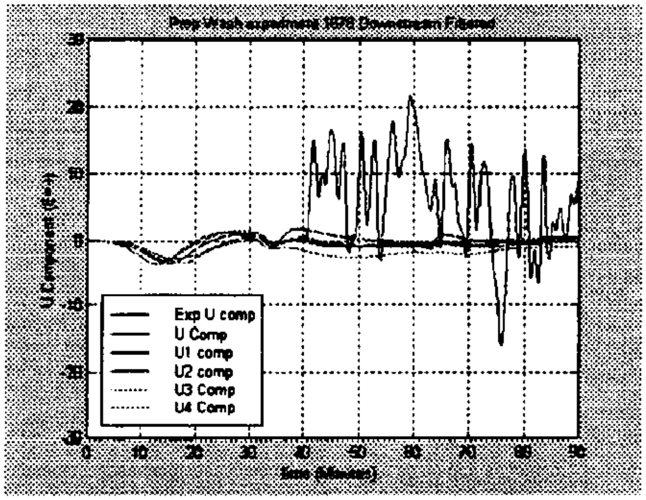

Figure 12a

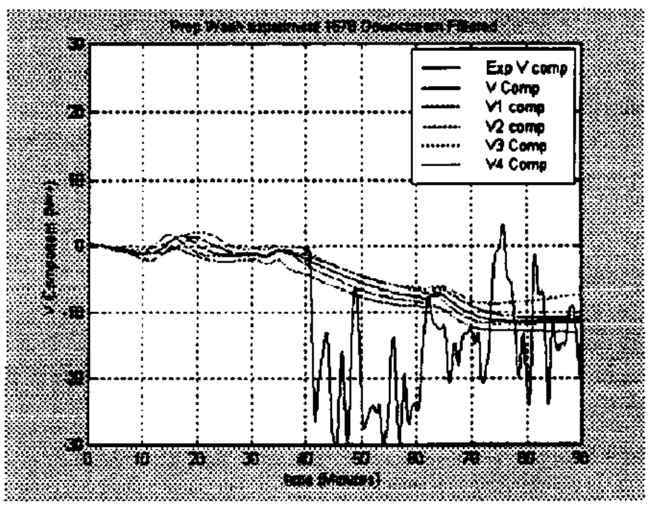

Figure 12b

None of the results of the starboard sensor, as seen in Figure 13a, demonstrates the right trend or magnitude. Figure 13b, however, shows that all of the alternate locations exhibit fairly good trends.

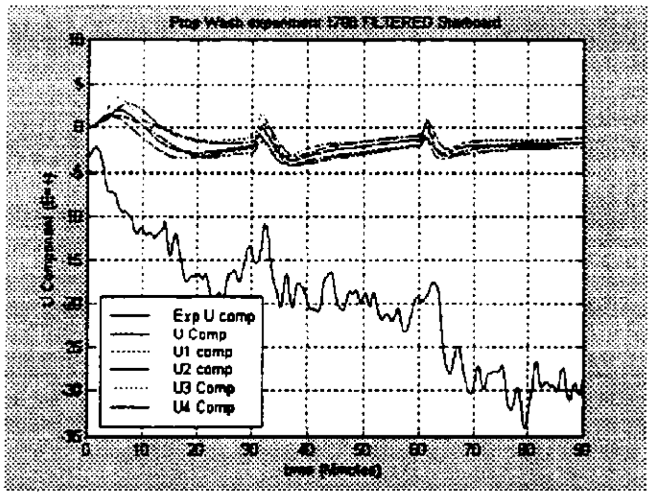

Figure 13a

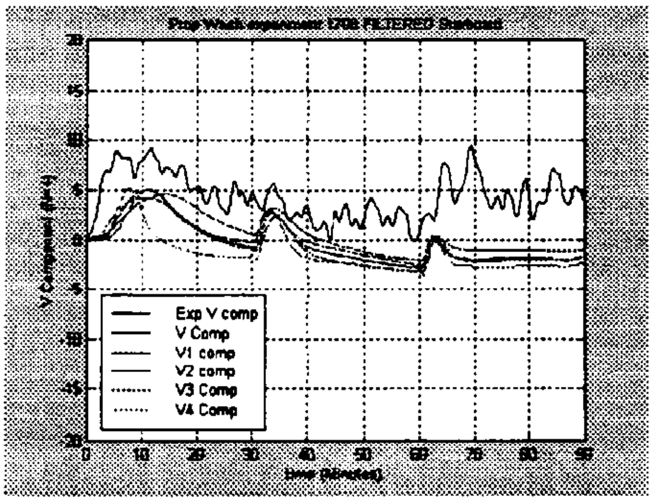

Figure 13b

For the sensor location on the port side of the harbor, 1709, Figure 14a demonstrates its sensitivity with the east/west flow. Furthermore, there appears to be a sensitivity in Figure 14b in which the flow shifts from the north to the south, indicating the presence of a vortex.

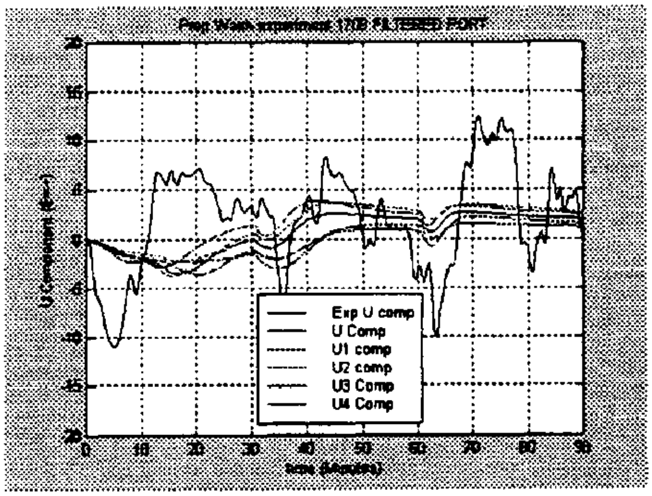

Figure 14a

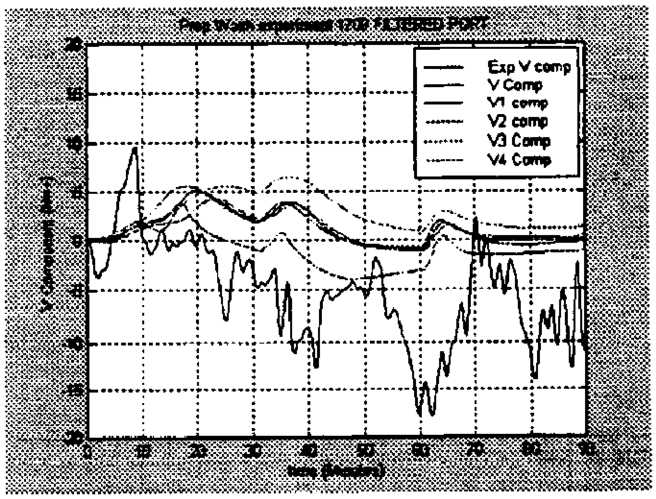

Figure 14b

52-Foot High Tide Study

Most of the qualitative descriptions detailed in the 42-foot deep comparison to experiment case are still valid for the 52-foot case. In this case, however, the depth of the plane in which the results are presented corresponds to 0.9569 meters above the bottom. The propeller was run at a constant value of 150 RPM. Figures 15a and 15b depict the resulting flow field that had developed at 11.96 minutes. It is interesting to note that the flow field is much more developed as compared to Figure 3a, which is further along in time but with lower RPM. This difference indicates the importance of modeling the experiment correctly, as the overall magnitudes of velocities and turbulent kinetic energy are not similar.

Observing Figure 15a, it can be seen that the vortex on the starboard side develops first, as it did with the 42-foot case. Furthermore, the highest velocity magnitude exists in the same approximate location as in the 42-foot case, although the magnitudes are different. It is also interesting to note that the flow demonstrates what was also seen in Figure 3a, as it is still in the stages of developing. The outer bands of the vortex still retain the high velocities.

Observing Figure 15b, the maximum turbulent kinetic energy exists once again on the starboard side of the figure, just around the area in which the maximum velocity exists.

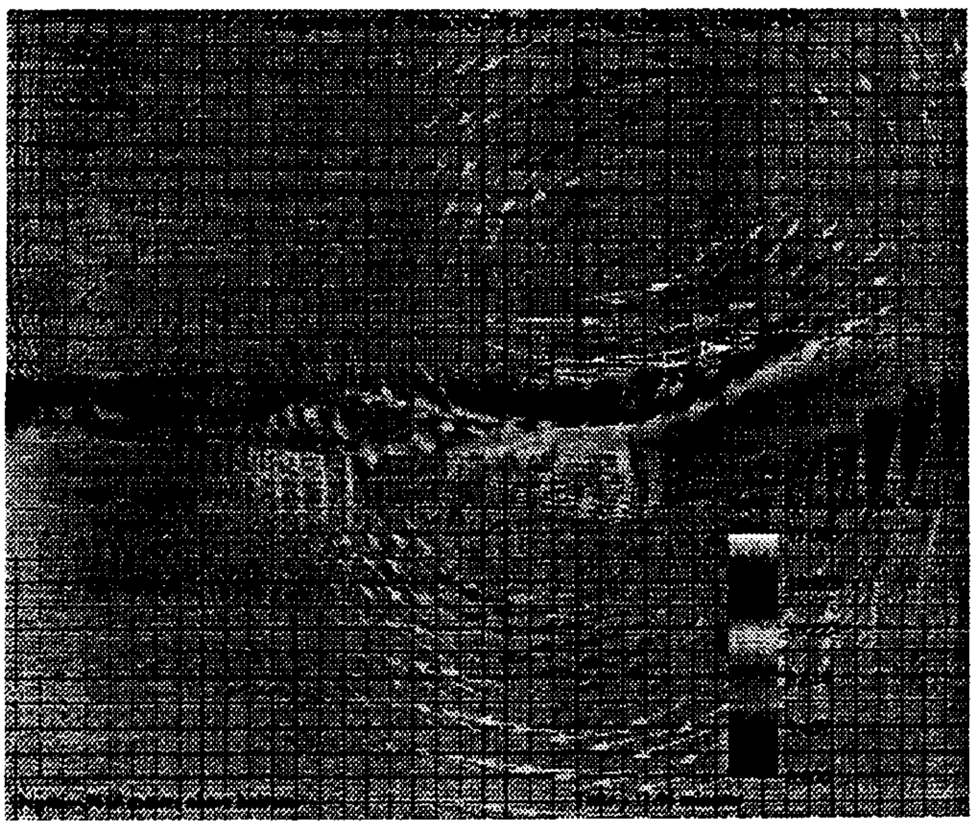

Figure 15a

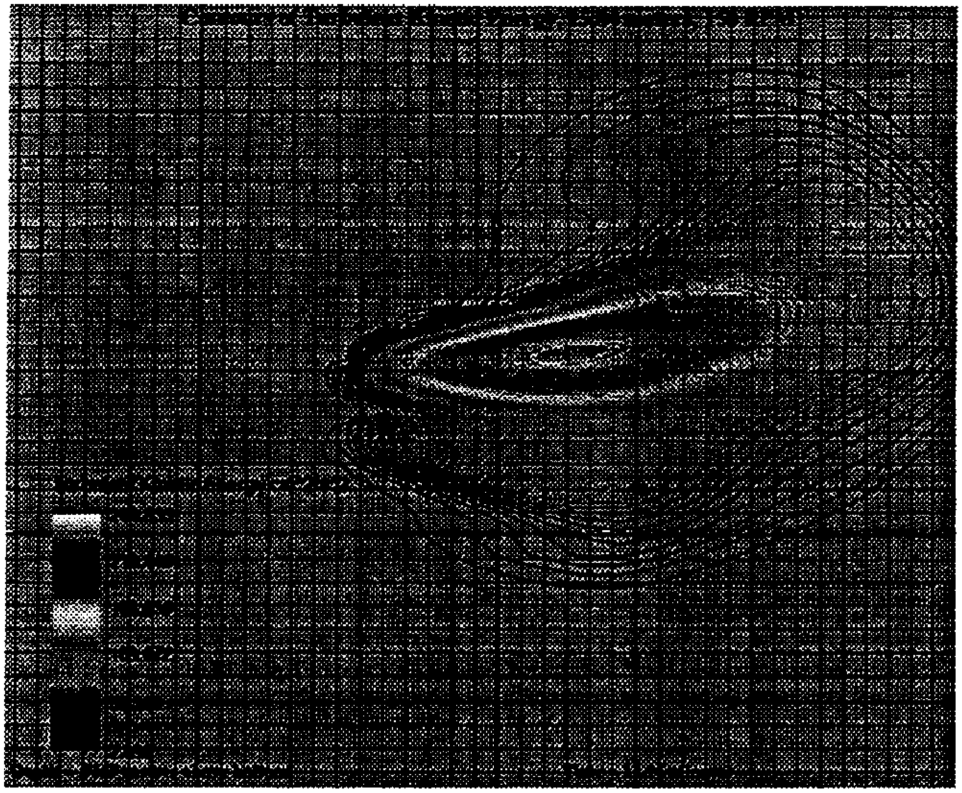

Figure 15b

Conclusion

In conclusion, many points have been learned through comparing the FANS solution to the experimental results. It has been determined from the first studies on the computational domain size that this domain must be both extremely wide and long to avoid boundary condition influences. Secondly, a larger-than-usual time step was required to perform these long simulations, but was made possible because of the high stability characteristics of the Cartesian grids employed. Third, it was seen in each of the cases that a right-hand turning propeller developed a vortex on the starboard side of the computational domain.

The FANS solution represents an ideal case, one in which many assumptions had to be made upon the operating conditions of the experiment. These assumptions include the following:

- A body force representation of the propeller
- A rigid lid for the free surface
- Constant depth
- No effect of a tidal current
- Zero pitch and zero sway of the tugboat

However, in the experiment, each of these assumptions is known not to be an accurate representation of the problem. Initially the propeller's tip vortices may have an impact on sensor readings. A body force representation of the propeller may not have been justified. The effect of any tidal current may also have had a major effect because it would shift the data from where it is placed in the computations, thereby profoundly effecting the results as seen in the sensitivity studies. The tugboat's pitch and yaw could also have had a major impact. Finally, the simplified model, which does not include the details of the rudder, may be too much of a gross approximation.

Overall, the comparison demonstrates that both methodologies, be it the FANS simulation or the experiment, have complexities and should be used together. It is not easy to say which methodology would best help analyze the flow patterns that develop in the harbor, nor is it easy to conclude that the FANS simulation or the experimental analysis is completely erroneous. The FANS simulation in this instance may have taken too many liberties in the assumptions, but these were forced due to limitations in computer resources. The experimental results contain many unknowns and not enough detail of the entire flow field. This work demonstrates that situations can be modeled using ideal conditions that may not be experimentally appropriate but that are suitable for existing resources. Using a combined approach where the RANS simulation is kept in check with the experimentation, and vice versa, seems to be a valid assumption at this stage. Using the advantages of both is necessary when determining the overall effect of the flow upon the harbor.

REFERENCES

Chen, H.C., and Korpus, R.A., 1993, "A Multi-Block Finite-Analytic Reynolds-Averaged Navier-Stokes method for 3-D Incompressible Flows." ASME *J. of Fluids Engineering.*

Chen, H.C., and Patel, V.C., 1988, "Near-Wall Turbulence Models for Complex Flows Including Separation," *AIAA Journal,* Vol. 26, No. 4, pp. 641-648.

Chen, H.c., and Patel, V.C., 1989, "The Flow Around Wing-Body Junctions," *Proceedings, 4th Symposium on Num. And Phys. Aspects of Aerodynamic Flows,* Long Beach, CA.

Chen, H.C., Patel, V.C., and Ju, S., 1990, "Solutions of Reynolds-Averaged Navier-Stokes Equations for Three-Dimensional Incompressible Flows," *J. of Computational Physics,* Vol. 88, No.2, pp. 305-336.

Hanjalic,K., and Launder, B.E., 1980, "Sensitizing the Dissipation Equation to Irrotational Strains," ASME *J. of Fluids Engineering,* Vol. 102.

Korpus,R., 1995, "Six Years of Progress Under the ARPA SUBTECH Program," SAIC Report No. 95/1143.

Korpus,R., and Falzarano, J.M., 1997, " Prediction of Viscous Ship Roll Damping by Unsteady Navier-Stokes Techniques," *J. of Offshore Mech. and Arctic Eng.*, vol. 119, no 2., pp. 108-113.

Weems, K., and Korpus, R., et al., 1994, "Near-Field Flow Predictions for Ship Design," *Proceedings, 20th Symposium Naval Hydrodynamics,* Santa Barbara, CA.

SECTION 4.4

PSNS SUPPLEMENTAL SEDIMENT QUALITY INFORMATION

SECTION 4.4
PSNS BREMERTON SUPPLEMENTAL SEDIMENT QUALITY INFORMATION

The data presented in Table 4.4-1 are for sediment samples collected in the vicinity of the planned berthing areas at PSNS (i.e., Piers B, D, and 3 and the proposed Turning Basins), the confined disposal facility sites (CDF1 and CDF2), and the confined aquatic disposal site (CAD). The following stations were chosen to represent each of the proposed areas being considered in this EIS (from DON 1996):

- Pier B and CDF2 Vicinity: Stations 121, 122, 456
- Pier D: Stations 111, 112, 454
- Pier 3: Stations 131, 132, 133, 457, 827
- Turning Basins: Stations 113, 118, 123, 468, 469, 470, 471, 482
- CDF1 Vicinity: Stations 480 and 129
- CAD: Stations 213, 214, 215, 218, 219, 220, 221, 222, 250, 251, 253, 254

Table 4.4-2 presents surface (top 4 feet) and subsurface sediment data for Pier D in 1991, prior to berth deepening at that pier. These data are from GeoEngineers (1991).

The three bioassays performed were (1) the acute test with the amphipod *Rhepoxynius abronius*, (2) the acute larval test with the echinoderm *Dendraster excentricus*, and (3) the chronic test with juvenile polychaete worm *Neanthes* sp. (see Table 4.4-3). These bioassay tests were performed on sediments from the following stations in each area:

- Pier B and CDF2 Vicinity: Station 456
- Pier D: Station 454
- Pier 3: Station 457
- Turning Basins: Stations 468, 469, 470, 471, 482
- CDF1 Vicinity: Station 480

Station locations are shown in Figure 4.4-1.

Table 4.4-1. Summary Chemistry for Proposed Dredging, CDF, and CAD Sites at PSNS (page 1 of 6)

Dredged Area	Pier B & CDF2			Pier D			PSDDA Screening Level (SL)	PSDDA Screening Level (ML)
	Average Detected Value	Range of Detections	Range of Nondetections	Average Value	Range of Detections	Range of Nondetections		
Conventional Parameters								
Total Organic Carbon (%)	3.3			3.52				
Fines (%)	55			88				
Metals (mg/kg dw)								
Antimony	8.8	8.8	28.1	U	U	31.4	20	200
Arsenic	12.3	9.8-14.2	D	16.9	13.2-20.6	D	57	700
Cadmium	4.2	4.1-4.2	2.8	3.2	2-4.4	3.1	0.96	9.6
Copper	212	200-2264	D	262	226-285	D	81	810
Lead	168	112-264	D	119	97.1-153	D	66	660
Mercury	0.70	0.45-1.1	D	1.3	1.1-1.6	D	0.21	2.1
Nickel	41.4	37.9-45.1	D	42.6	39.4-46.8	D	140	None
Silver	U	U	0.61-5.6	1.65	1.65-1.7	6.3	1.2	6.1
Zinc	403	238-694	D	298	298-299	D	160	1,600
Organotins (µg/kg dw)								
Tributyltin	U	U	125	8.41	214	D		
LPAH (µg/kg dw)								
Acenaphthalene	19	19	3600-4500	29	29	500-560	64	640
Acenaphthene	180	9-350	4500	32	32	500-560	63	630
Anthracene	633	65-1200	4500	147	70-230	D	130	1,300
Fluorene	470	20-470	4500	48	48	500-560	64	640
Naphthalene	20	20	3600-4500	28	28	500-560	210	2,100
Phenanthrene	2400	230-6500	D	417	U	250-550	320	3,200
2-Methylnaphthalene	U	U	260-4500	16	16	500-560	67	670
Total LPAH	3720	363-8520	260-4500	701	390-773	250-560	610	6,100
HPAH (µg/kg dw)								
Benzo(a)anthracene	1400	260-3200	D	570	530-610	500	450	4,500
Benzo(a)pyrene	1220	220-2800	D	460	360-630	D	680	6,800
Benzofluoranthenes	5100	320-6000	D	1760	470-1100	D	800	8,000
Benzo(ghi)perylene	695	90-1300	4500	239	78-400	500	540	5,400
Chrysene	1690	380-3700	D	553	490-600	D	670	6,700
Dibenzo(a,h)anthracene	34	34	3600-4500	68	68	500-560	120	1,200
Fluoranthene	3010	420-7400	D	660	650-680	650	630	6,300
Indeno(1,2,3-cd)pyrene	845	90-1600	4500	170	170	500-560	69	5,200

Table 4.4-1. Summary Chemistry for Proposed Dredging, CDF, and CAD Sites at PSNS (page 2 of 6)

Dredged Area	Pier B & CDF2 Average Detected Value	Pier B & CDF2 Range of Detections	Pier B & CDF2 Range of Nondetections	Pier D Average Value	Pier D Range of Detections	Pier D Range of Nondetections	PSDDA Screening Level (SL)	PSDDA Screening Level (ML)
Pyrene	2540	620-5800	D	830	770-880	D	430	7,300
Total HPAH	16500	2824-37800	3600-4500	5310	3530-5970	500-650	1,800	51,000
Phthalates and Phenols (µg/kg dw)								
Bis(2-ethylhexyl)phthalate	13900	330-40000	D	780	460-1100	5600	3,100	None
Butyl benzyl phthalate	35	25	360-450	110	110	5000-5600	470	None
Diethyl phthalate	U	U	260-4500	16	U	16-5600	97	None
Di-n-butyl phthalate	U	U	260-4500	--	U	5000-5600	1,400	None
Di-n-octyl phthalate	U	U	260-4500	--	U	300-5600	6,200	None
Phenol	U	U	260-**4500**	--	U	300-**5600**	120	1,200
4-Methylphenol	17	17	**3600-4500**	19	19	**5000-5600**	120	1,200
Dibenzofuran	9	9	**3600-4500**	26	26	**5000-5600**	54	540
Pesticides & PCB's (µg/kg dw)								
Total DDT	**575**	**40-670**	35-44	**635**	U	48-54	6.9	69
Total PCBs	965	110-1700	20.5-220	--	160-790	24.2-540	130	2,500

Table 4.4-1. Summary Chemistry for Proposed Dredging, CDF, and CAD Sites at PSNS

Dredged Area	Pier 3			Turning Basins			PSDDA Screening Level (SL)	PSDDA Screening Level (ML)
	Average Detected Value	Range of Detections	Range of Nondetections	Average Value	Range of Detections	Range of Nondetections		
Conventional Parameters								
Total Organic Carbon (%)	2.11			3.14				
Fines (%)	80			92				
Metals (mg/kg dw)								
Antimony	21.9	21.9	27.4	U	U	26.6	20	200
Arsenic	45	12.5-95.4	D	16.1	12.9-23	D	57	700
Cadmium	5.1	3.8-6.1	2-2.7	2.7	2-3.5	2.7-5.3	0.96	9.6
Copper	743	48.2-1700	D	174	109-254	D	81	810
Lead	228	85.6-581	D	105	83-157	D	66	660
Mercury	2.2	0.68-6.5	D	0.92	0.33-1.2	D	0.21	2.1
Nickel	50.5	41.5-70	D	42	35.1-47	0.69-10.6	140	None
Silver	--	U	0.67-5.5	1.3	1.4	D	1.2	6.1
Zinc	617	138-1230	D	216	157-281		160	1,600
Organotins (μg/kg dw)								
Tributyltin	42.1	U	614	--	--	--		
LPAH (μg/kg dw)								
Acenaphthalene	29	22-36	64-5500	U	U	280-5300	64	640
Acenaphthene	60	60	64-5500	U	U	280-5300	63	630
Anthracene	701	63-280	64-4100	96	12-180	290-5100	130	1,300
Fluorene	320	55-320	64-5500	U	U	280-5300	64	640
Naphthalene	45	28-61	74-5500	7	7.0	280-5300	210	2,100
Phenanthrene	797	55-1800	74	88	26-350	3800-5100	320	3,200
2-Methylnaphthalene	18	18	44-5500	U	U	280-5300	67	670
Total LPAH	1950	83-2120	44-5500	191	26-530	280-5300	610	6,100
HPAH (μg/kg dw)								
Benzo(a)anthracene	683	620-9780	64-74	158	38-580	5100	450	4,500
Benzo(a)pyrene	432	320-770	D	166	24-450	D	680	6,800
Benzofluoranthenes	1830	89-1600	64-74	699	44-1000	D	800	8,000
Benzo(ghi)perylene	119	67-170	64-5500	U	U	280-5300	540	5,400
Chrysene	627	40-1100	D	217	38-630	D	670	6,700
Dibenzo(a,h)anthracene	86	86	64-5500	U	U	28-5300	120	1,200
Fluoranthene	1210	54-1800	D	280	44-290	D	630	6,300
Indeno(1,2,3-cd)pyrene	313	180-380	64-5500	U	U	280-5300	69	5,200

Table 4.4-1. Summary Chemistry for Proposed Dredging, CDF, and CAD Sites at PSNS (page 4 of 6)

Dredged Area	Pier 3			Turning Basins				
	Average Detected Value	Range of Detections	Range of Nondetections	Average Value	Range of Detections	Range of Nondetections	PSDDA Screening Level (SL)	PSDDA Screening Level (ML)
Pyrene	1180	89-1400	74	334	73-1000	D	430	7,300
Total HPAH	6480	662-9780	64-5500	1850	330-5580	28-5300	1,800	51,000
Bis(2-ethylhexyl)phthalate	3530	1-6300	64-5500	1650	1300-2000	280-3800	3,100	None
Butyl benzyl phthalate	460	240-680	4100-5500	U	U	280-5300	470	None
Diethyl phthalate	--	U	64-5500	U	U	280-5300	97	None
Di-n-butyl phthalate	1580	300-2800	64-5500	U	22-28	280-5300	1,400	None
Di-n-octyl phthalate	71	71	64-5500	25	U	280-5300	6,200	None
Phenol	420	420	64-5500	U	U	280-5300	120	1,200
4-Methylphenol	820	820-5400	64-5500	U	290	280-5300	120	1,200
Dibenzofuran	30	30	64-5500	U	U	280-5300	54	540
Pesticides & PCB's (µg/kg dw)								
Total DDT	--		11-53	U	U	37-51	6.9	69
Total PCBs	255		9.5-530	170	60-120	22-510	130	2,500

Table 4.4-1. Summary Chemistry for Proposed Dredging, CDF, and CAD Sites at PSNS (page 5 of 6)

Dredged Area	CDF1 Average Detected Value	CDF1 Range of Detections	CDF1 Range of Nondetections	CAD Average Value	CAD Range of Detections	CAD Range of Nondetections	PSDDA Screening Level (SL)	PSDDA Screening Level (ML)
Conventional Parameters								
Total Organic Carbon (%)	3.0			5.3				
Fines (%)	65.5			68.7				
Metals (mg/kg dw)								
Antimony	NA	NA	NA	6.6	16.3-18.4	5.6-11.4	20	200
Arsenic	21.5	15.2-27.9	D	33.3	15.9-67	D	57	700
Cadmium	3.3	3-3.6	D	5.1	2.2-15.7	0.69-1.7	0.96	9.6
Copper	309	216-402	D	372	248-757	D	81	810
Lead	299	138-460	D	241	123-582	D	66	660
Mercury	0.73	.072-0.87	D	1.4	0.65-2.9	D	0.21	2.1
Nickel	45.2	43.6-46.8	D	44.8	35.5-54.2	42.4	140	None
Silver	U	U	0.67-4.5	2.5	1.5-3.9	1.6-1.7	1.2	6.1
Zinc	713	306-1120	D	680	304-1510	D	160	1,600
Organotins (µg/kg dw)								
Tributyltin	NA	NA	NA		800	1570		
LPAH (µg/kg dw)								
Acenaphthalene	U	U	242-4020	35	36-109	3104-8174	64	640
Acenaphthene	33	66.6	4020	99	21-581	100-8558	63	630
Anthracene	154	131-169	D	315	56-1599	8558	130	1,300
Fluorene	20	40.5	4020	168	26-1098	3104-8558	64	640
Naphthalene	14	28.2	4020	22	26-110	52-8558	210	2,100
Phenanthrene	529	359-687	D	1725	199-9500	8558	320	3,200
2-Methylnaphthalene	9	18	4020	33	43-120	56-8558	67	670
Total LPAH	750	530-954	D	2364	339-12882	8558	610	6,100
HPAH (µg/kg dw)								
Benzo(a)anthracene	489	388-576	D	730	210-1429	8558	450	4,500
Benzo(a)pyrene	387	342-420	D	398	210-979	1900-8558	680	6,800
Benzofluoranthenes	1236			2820		581-8558	800	8,000
Benzo(ghi)perylene	46	93	4020	135	92-406		540	5,400
Chrysene	588	567-588	D	799	249-1068	8558	670	6,700
Dibenzo(a,h)anthracene	U	U	242-4020	35	39-369	52-8558	120	1,200
Fluoranthene	931	629-1212	D	1593	299-2962	D	630	6,300
Indeno(1,2,3-cd)pyrene	154	121-180	D	143	119-515	809-8558	69	5,200

Table 4.4-1. Summary Chemistry for Proposed Dredging, CDF, and CAD Sites at PSNS (page 6 of 6)

Dredged Area	CDF1 Average Detected Value	CDF1 Range of Detections	CDF1 Range of Nondetections	CAD Average Value	CAD Range of Detections	CAD Range of Nondetections	PSDDA Screening Level (SL)	PSDDA Screening Level (ML)
Pyrene	961			1514			430	7,300
Total HPAH	4792	4234-5190	D	8167	2699-9880	D	1,800<	51,000
Bis(2-ethylhexyl)phthalate	408	456-788	D	1250	329-3518	D	3,100	None
Butyl benzyl phthalate	228	456	4020	30	62-219	44-8558	470	None
Diethyl phthalate	8	16.17	4020	U	U	44-8558	97	None
Di-n-butyl phthalate	50	101	4020	U	U	44-8558	1,400	None
Di-n-octyl phthalate	U	U	4020	U	U	44-8558	6,200	None
Phenol	U	U	7.2-117	U	U	44-5200	120	1,200
4-Methylphenol	380	0.08	117	6	26-46	44-5200	120	1,200
Dibenzofuran	9.6	U	4020	68	16-89	91-8558	54	540
Pesticides & PCB's (µg/kg dw)								
Total DDT	U	U	39.3	750	10.85-594	22-252	6.9	69
Total PCBs	213	423	393	360	99-1066	596-836	130	2,500

-- Data for this parameter was either not detected for all stations or considered unusable by URS (e.g., Rejected data)

SL Exceedances Numbers surrounded by a border exceed corresponding PSDDA SL values.
ML Exceedances Numbers surrounded by a border, bold, and shaded exceed corresponding PSDDA ML values.

Table 4.4-2. Surface and Subsurface Sediment Chemistry[a] for Pier D at PSNS, 1991 (page 1 of 2)

Compound	SURFACE (top 4 ft) Total Dry Weight Detected Concentration	SURFACE (top 4 ft) Total Dry Weight Detection Limits for Nondetects	SUBSURFACE (below 4 ft) Total Dry Weight Detected Concentration	SUBSURFACE (below 4 ft) Total Dry Weight Detection Limits for Nondetects
Conventional Parameters				
Total Organic Carbon (%)	2.471		1.375	
Fines (%)				
Inorganic Substances	mg/kg	mg/kg	mg/kg	mg/kg
Antimony	0.51-16	D	0.48-3.5	0.06
Arsenic	24-32	1.6-4.3	14-31	1.8-3.6
Cadmium	0.35-2.4	D	0.4-1.4	D
Copper	17-380	D	4.4-150	D
Lead	16-260	2.5-2.6	4-70	2.4-2.9
Mercury	**0.067-3.64**	D	0.034-1.17*	D
Nickel	11-110	D	9.9-94	D
Silver	0.25-2.9	D	0.06-0.83	D
Zinc	72-730	D	12-190	D
Organotins	µg TBT/kg	µg TBT/kg	µg TBT/kg	µg TBT/kg
Tributyltin	—	—	—	—
Nonionizable Organic Chemicals	µg/kg	µg/kg	µg/kg	µg/kg
Total LPAH	32-1200	20-55	25-160	17-33
Acenaphthylene	U	20-55	U	17-33
Acenaphthene	32-66	20-55	33	17-33
Anthracene	34-690	20-36	46	17-33
Fluorene	32-66	20-51	42	17-33
Naphthalene	60-200	20-51	160	17-33
Phenanthrene	41-1200	30-36	100	17-33
2-Methylnaphthalene	32-61	20-51	25	17-33
Total HPAH	33-6700	20-51	22-1300	17-33
Benzo(a)anthracene	35-2300	30-36	U	17-33
Benzo(a)pyrene	48-1400	34-36	180	17-33
Benzofluoranthenes	36-2500	34-36	27-270	17-33
Benzo(g,h,i)perylene	41-460	30-36	100	17-33
Chrysene	33-3700	34-36	120	17-33
Dibenzo(a,h)anthracene	46-83	20-51	U	17-33
Fluoranthene	35-4400	30-36	110	17-33
Indeno(1,2,3-cd)pyrene	45-600	30-36	100	17-33
Pyrene	51-6700	34-36	22-1300	21-31
Hexachlorobenzene	U	13-33	U	10-20
1,2-Dichlorobenzene	U	2.4-7.3	U	2.4-6.7
1,3-Dichlorobenzene	U	2.4-7.3	U	2.4-6.7
1,4-Dichlorobenzene	U	2.4-7.3	U	2.4-6.7
1,2,4-Trichlorobenzene	U	4.1-11	U	4.2-6.5
Bis(2-ethylhexyl)phthalate	73-2100	36	29-440	D
Butyl benzyl phthalate	160	20-55	U	17-33
Diethyl phthalate	U	20-55	U	17-33
Dimethyl phthalate	U	20-55	U	17-33
Di-n-butyl phthalate	66-88	20-55	U	17-33
Di-n-octyl phthalate	U	20-55	U	17-33

Table 4.4-2. Surface and Subsurface Sediment Chemistry[a] for Pier D at PSNS, 1991 (page 2 of 2)

Compound	SURFACE (top 4 ft) Total Dry Weight Detected Concentration	Detection Limits for Nondetects	SUBSURFACE (below 4 ft) Total Dry Weight Detected Concentration	Detection Limits for Nondetects
N-Nitrosodiphenylamine	U	12-33	U	10-20
Hexachlorobutadiene	U	20-55	U	17-33
Hexachloroethane	U	20-55	U	17-33
Dibenzofuran	52-94	20-51	52	17-33
Ionizable Organic Chemicals	μg/kg	μg/kg	μg/kg	μg/kg
Phenol	U	20-55	U	17-33
4-Methylphenol	110	20-51	U	17-33
Pentachlorophenol	U	61-170	U	52-98
2-Methylphenol	U	6.1-17	U	6.1-9.8
2,4-Dimethylphenol	U	6.1-17	U	6.1-9.8
Benzyl Alcohol	U	8.2-22	U	8.2-13
Benzoic Acid	U	100-280	U	86-160
Pesticides & PCB's	μg/kg	μg/kg	μg/kg	μg/kg
Total DDT	**1.4-640**	0.70-28	0.45-29	0.70-3.4
Total PCBs	84-1000	9-120	9.4-160	12-17

a Values in table represent the range of all detected results and the range of detection limits for all undetected results for stations within the proposed dredge area. Data was taken from GeoEngineers (1991). Surface samples represent the top four feet of sediment. Sampling occurred between 3/91 and 4/91. Data are from 20 surface samples, and 20 subsurface samples composited into 8 samples for testing.

– Data for this parameter was considered unusable by URS (e.g. rejected data).

Exceeds PSDDA SL

Exceeds PSDDA ML

Notes:
D Compound was detected at all stations, so no detection limits are provided
ML Maximum Level
SL Screening Level
U Compound was undetected at all stations

Table 4.4-3. Sediment Bioassay Results for PSNS and Comparison to Sediment Management Standards

	Amphipod		Echinoderm Larva		Neanthes Growth	
	Mortality (%)	*SMS Exceedance*	*TEM[1] (%)*	*SMS Exceedance*	*Biomass (mg/org.)*	*SMS Exceedance*
Pier B and CDF2 Vicinity						
Station 456	35	SQS[2]	8.0	None	18.0	None
Pier D						
Station 454	25	None	24.4	None	16.2	None
Pier 3						
Station 457	24	None	8.3	None	16.1	None
Turning Basin						
Station 468	37	SQS	17.5	None	20.9	None
469	31	SQS	10.8	None	23.1	None
470	29	None	24.3	None	20.6	None
471	21	None	17.6	None	20.8	None
482	31	None	19.7	None	22.3	None
CDF1 Vicinity						
Station 480	33	None	6.7	None	18.2	None

1 TEM = Total effective mortality, which is larval mortality plus abnormality.
2 SQS = Sediment quality standard, which is the more stringent SMS criterion, indicating potential adverse effects, but not necessarily requiring remediation.

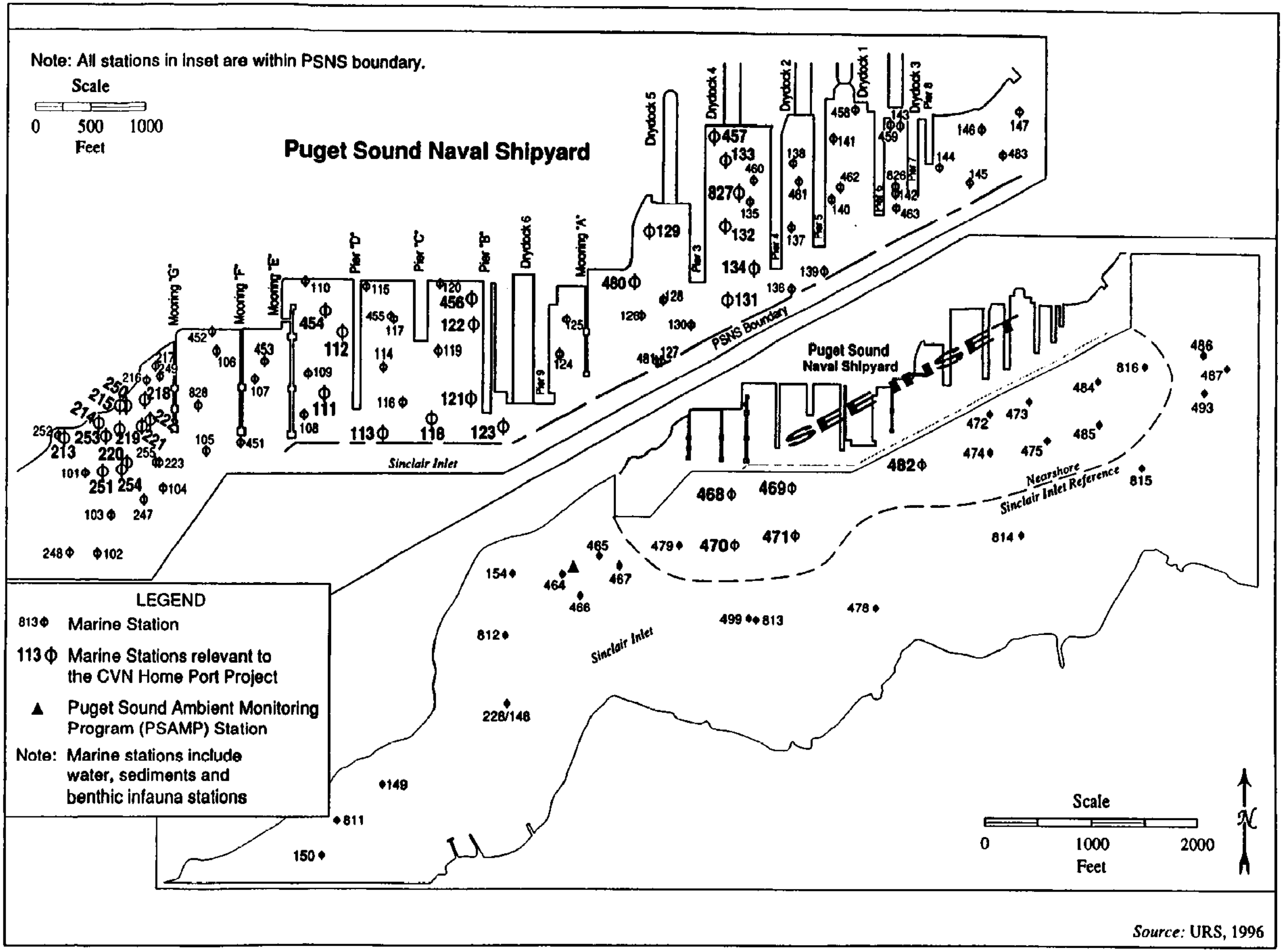

Figure 4.4-1. Sediment Sampling Locations, PSNS

SECTION 4.9

PSNS SUPPLEMENTAL TRANSPORTATION INFORMATION

SECTION 4.9
PSNS BREMERTON SUPPLEMENTAL TRAFFIC INFORMATION

Table 4.9-5 provides impacts on daily traffic volumes from the addition of 1 additional CVN and removal of 2 AOEs. The impacts of the additional traffic on intersection levels of service at are shown on Table 4.9-6. Tables 4.9-7 and 4.9-8 address impacts of the No Action Alternative.

Table 4.9-5 Impact on Daily Traffic Volumes
1 Additional CVN & Removal of 2 AOEs at PSNS Bremerton

Roadway/Location	Baseline Traffic Volume & V/C	Project Traffic	Traffic Volume w/ Project & V/C
State Route 3			
At Kitsap Way	36,000 - 0.45	120	36,120 - 0.45
North of SR 304	24,000 - 0.30	0	24,000 - 0.30
South of SR 304	56,000 - 0.70	250	56,250 - 0.70
Burwell Street	19,100 - 0.96	250	19,350 - 0.97
Sixth Street	20,400 - 0.68	50	20,450 - 0.68
Eleventh Street	25,400 - 0.64	40	25,440 - 0.64
Farragut Street	33,000 - 0.82	250	33,250 - 0.83
Kitsap Way	41,700 - 1.04	140	41,840 - 1.05
Arsenal Way	6,800 - 0.45	10	6,810 - 0.45
Loxi Eagans Boulevard	12,300 - 0.82	10	12,310 - 0.82
Cambrian Avenue	37,100 - 0.93	250	37,350 - 0.93
Wykoff Avenue	2,400 - 0.24	0	2,400 - 0.24
Callow Avenue	25,100 - 0.63	100	25,200 - 0.63
Montgomery Avenue	9,000 - 0.90	300	9,300 - 0.93
Naval Avenue	13,500 - 0.45	40	13,540 - 0.45
Warren Avenue	36,600 - 0.92	90	36,690 - 0.92
Washington Avenue	11,700 - 0.29	30	11,730 - 0.29
Wheaton Way	37,500 - 0.94	90	37,590 - 0.94
Warren Avenue Bridge	49,600 - 1.24	150	49,750 - 1.24
Manette Bridge	18,500 - 0.92	30	18,530 - 0.93

Table 4.9-6 Impact on Intersection Levels of Service 1 Additional CVN & Removal of 2 AOEs at PSNS Bremerton		
Intersection	**PM Peak Hour Delay (sec) - V/C Ratio -LOS**	
	Without Project	**With Project**
Wheaton/Sylvan	34.3 - 0.84 - D	34.7 - 0.85 - D
Wheaton/Sheridan	54.8 - 0.92 - E	56.7 - 0.93 - E
Washington/Manette Bridge	10.4 - 0.77 - B	10.8 - 0.78 - C
6th/Washington	10.0 - 0.73 - B	10.3 - 0.74 - B
Burwell/Washington	11.3 - 0.51 - B	11.4 - 0.51 - B
Burwell/Warren	47.9 - 1.05 - E	50.2 - 1.06 - E
6th/Warren	20.5 - 0.85 - C	21.9 - 0.86 - C
11th/Warren	28.9 - 0.89 - D	30.1 - 0.90 - D
16th/Warren	9.4 - 0.82 - B	9.6 - 0.84 - B
11th/Naval	16.3 - 0.70 - C	16.5 - 0.70 - C
6th/Naval	14.0 - 0.69 - B	14.2 - 0.69 - B
Burwell/Naval	19.0 - 0.89 - C	20.1 - 0.90 - C
Burwell/Montgomery	35.8 - 0.94 - D	37.8 - 0.96 - D
6th/Montgomery	20.0 - 0.85 - C	22.5 - 0.90 - C
11th/Callow	14.7 - 0.64 - B	15.1 - 0.66 - C
6th/Callow	16.1 - 0.73 - C	16.4 - 0.75 - C
Callow/Burwell	18.7 - 0.87 - C	19.8 - 0.90 - C
Farragut/Callow	33.5 - 0.82 - D	36.1 - 0.85 - D
Cambrian(SR 304)/West Gate	22.4 - 0.94 - C	29.1 - 0.98 - C
Loxi Eagans/National	14.3 - 0.71 - B	14.3 - 0.71 - B
11th/Kitsap	23.9 - 0.85 - C	25.9 - 0.88 - D
Shorewood/Kitsap	7.8 - 0.69 - B	8.0 - 0.71 - B
Kitsap/SR 3 Ramps	76.8 - 1.12 - F	78.1 - 1.13 - F

Table 4.9-7 Impact on Daily Traffic Volumes No Action Alternative: 1 Additional CVN at PSNS Bremerton			
Roadway/Location	**Baseline Traffic Volume & V/C**	**Project Traffic**	**Traffic Volume w/ Project & V/C**
State Route 3			
At Kitsap Way	36,000 - 0.45	290	36,290 - 0.45
North of SR 304	24,000 - 0.30	0	24,000 - 0.30
South of SR 304	56,000 - 0.70	620	56,620 - 0.71
Burwell Street	19,100 - 0.96	620	19,720 - 0.99
Sixth Street	20,400 - 0.68	130	20,530 - 0.68
Eleventh Street	25,400 - 0.64	110	25,510 - 0.64
Farragut Street	33,000 - 0.82	620	33,620 - 0.84
Kitsap Way	41,700 - 1.04	350	42,050 - 1.05
Arsenal Way	6,800 - 0.45	20	6,820 - 0.45
Loxi Eagans Boulevard	12,300 - 0.82	20	12,320 - 0.82
Cambrian Avenue	37,100 - 0.93	620	37,720 - 0.94
Wykoff Avenue	2,400 - 0.24	0	2,400 - 0.24
Callow Avenue	25,100 - 0.63	250	25,350 - 0.63
Montgomery Avenue	9,000 - 0.90	750	9,750 - 0.97
Naval Avenue	13,500 - 0.45	90	13,590 - 0.45
Warren Avenue	36,600 - 0.92	220	36,820 - 0.92
Washington Avenue	11,700 - 0.29	70	11,770 - 0.29
Wheaton Way	37,500 - 0.94	220	37,720 - 0.94
Warren Avenue Bridge	49,600 - 1.24	370	49,970 - 1.25
Manette Bridge	18,500 - 0.92	70	18,570 - 0.93

Table 4.9-8 Impact on Intersection Levels of Service No Action Alternative: 1 Additional CVN at PSNS Bremerton		
Intersection	**PM Peak Hour Delay (sec) - V/C Ratio -LOS**	
	Without Project	**With Project**
Wheaton/Sylvan	34.3 - 0.84 - D	35.2 - 0.86 - D
Wheaton/Sheridan	54.8 - 0.92 - E	58.9 - 0.93 - E
Washington/Manette Bridge	10.4 - 0.77 - B	11.2 - 0.79 - C
6th/Washington	10.0 - 0.73 - B	10.8 - 0.76 - B
Burwell/Washington	11.3 - 0.51 - B	11.6 - 0.52 - B
Burwell/Warren	47.9 - 1.05 - E	52.1 - 1.06 - E
6th/Warren	20.5 - 0.85 - C	23.4 - 0.88 - C
11th/Warren	28.9 - 0.89 - D	31.0 - 0.92 - D
16th/Warren	9.4 - 0.82 - B	9.8 - 0.86 - B
11th/Naval	16.3 - 0.70 - C	16.8 - 0.71 - C
6th/Naval	14.0 - 0.69 - B	14.4 - 0.70 - B
Burwell/Naval	19.0 - 0.89 - C	21.5 - 0.92 - C
Burwell/Montgomery	35.8 - 0.94 - D	39.7 - 0.99 - D
6th/Montgomery	20.0 - 0.85 - C	24.9 - 0.94 - C
11th/Callow	14.7 - 0.64 - B	15.5 - 0.68 - C
6th/Callow	16.1 - 0.73 - C	16.9 - 0.77 - C
Callow/Burwell	18.7 - 0.87 - C	20.7 - 0.95 - D
Farragut/Callow	33.5 - 0.82 - D	39.8 - 0.90 - D
Cambrian(SR 304)/West Gate	22.4 - 0.94 - C	37.5 - 1.05 - D
Loxi Eagans/National	14.3 - 0.71 - B	14.3 - 0.71 - B
11th/Kitsap	23.9 - 0.85 - C	28.7 - 0.91 - D
Shorewood/Kitsap	7.8 - 0.69 - B	8.2 - 0.73 - B
Kitsap/SR 3 Ramps	76.8 - 1.12 - F	79.2 - 1.13 - F

SECTION 4.10

PSNS SUPPLEMENTAL AIR QUALITY INFORMATION

SECTION 4.10

PSNS BREMERTON

SUPPLEMENTAL AIR QUALITY INFORMATION

Table 4.10-1 provides the national and Washington state ambient air quality standards. Table 4.10-2 provides the 1996 Stationary/Area Source Emissions Inventory for PSNS Bremerton.

Regulation I, Article 5, Registration. This rule identifies sources and thresholds that trigger emission source registration, fee, and reporting requirements. This rule is closely related to the requirements of Regulation I, Article 7, Operating Permits (see below).

Regulation I, Article 6, New Source Review. This rule outlines the process to permit new stationary sources of air pollution. Sources subject to this rule (such as natural gas-fired boilers larger than 10 million British thermal units [BTUs] per hour) are required to obtain an approved Notice for Construction (NC) and Application for Approval from the PSAPCA prior to construction. This rule includes the requirement for new sources to install Best Available Control Technologies (BACT). PSNS Bremerton presently has many sources that operate under NC permits (personal communication, Claude Williams 1997).

Regulation I, Article 7, Operating Permits. This rule outlines requirements to satisfy the federal operating permit program defined in Title V of the 1990 CAA. Generally, any source that exceeds 100 tons per year of a regulated pollutant, 10 tons per year of a hazardous air pollutant (HAP), or 25 tons per year of combined HAPs requires an operating permit under this rule. This rule requires the submission of annual emission inventories and fees to the PSAPCA if an operating permit source (such as ship building and repair) exceeds the following annual thresholds: (1) 25 tons (22,680 kg) of CO, NO_x, PM_{10}, SO_x, or VOC; (2) 2 tons (1,815 kg) of a single toxic air contaminant (TAC); or (3) 5 tons (4,536 kg) of combined TACs from an entire facility. Since NSPS Bremerton presently exceeds these thresholds, the facility is subject to the requirements of this rule. Consequently, some emission sources associated with the project alternatives would also be subject to these requirements. PSNS Bremerton submitted an application for a Title V permit to the PSAPCA in June 1995, since the facility exceeds some of these thresholds. Issuance of this permit by the PSAPCA is expected in 1998 (personal communications, Clark Pitchford 1997).

Tables 4.10-3 through 4.10-25 present calculations used to estimate source emissions for all alternative components at PSNS Bremerton.

Table 4.10-1. National and Washington Ambient Air Quality Standards

Pollutant	Averaging Time	Washington Standards	National Standards (a) Primary (b,c)	National Standards (a) Secondary (b,d)
Ozone	8-hour	—	0.08 ppm (160 ug/m³)	Same as primary
	1-hour	0.12 ppm (235 µg/m³	0.12 ppm (235 µg/m³)	Same as primary
Carbon monoxide	8-hour	9 ppm (10 mg/m³)	9 ppm (10 mg/m³)	—
	1-hour	35 ppm (40 mg/m³)	35 ppm (40 mg/m³)	—
Nitrogen dioxide	Annual	0.053 ppm (100 µg/m³)	0.053 ppm (100 µg/m³)	Same as primary
	1-hour	—	—	—
Sulfur dioxide	Annual	0.02 ppm (53 µg/m³)	0.03 ppm (80 µg/m³)	—
	24-hour	0.10 ppm (261 µg/m³)	0.14 ppm (365 µg/m³)	—
	3-hour	—	—	0.5 ppm (1,300 µg/m³)
	1-hour	0.25[e]/0.40 ppm	—	—
PM10	Annual (arithmetic)	50 µg/m³	50 µg/m³	Same as primary
	Annual (geometric)	—	—	—
	24-hour	150 µg/m³	150 µg/m³	Same as primary
PM2.5	Annual (arithmetic)	—	15 µg/m³	Same as primary
	24-hour	—	65 µg/m³	Same as primary
Lead	Calendar quarter	1.5 µg/m³	1.5 µg/m³	Same as primary
	30-day average	—	—	—

Notes:
(a) Standards, other than for ozone and those based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.
(b) Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parenthesis.
(c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each state must attain the primary standards no later than 3 years after that states implementation plan is approved by the EPA.
(d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
(e) Not to be exceeded more than twice in 7 consecutive days.

Table 4.10-2

1996 Stationary/Area Source Emissions for Puget Sound Naval Shipyard Bremerton (Tons/Year)

Source Type	*VOC*	*CO*	*NO_x*	*SO_x*	*PM_{10}*
Coal-fired Boilers	0.4	27	77	16	4
Diesel-Fired Boilers	0.1	1.3	5	19	0.3
Natural Gas-Fired Boilers	0.4	9	24	0.1	0.7
Surface Coatings/Solvents	112				27
Degreasing	3				
Gasoline Retail Operations	2				
Cold Solvent Cleaning	12				
Organic Solvent Evaporation	1				
Abrasive Blasting					12
Metal Cutting/Grinding/Welding					55
Diesel-powered IC Engines	0.8	7	25	4	0.8
Steel Foundries Casting Shakeout					1
Miscellaneous Industrial Processes	8	0.1			
Total Tons/Year	**160**	**45**	**133**	**39**	**96**

Source: PSNS Bremerton. 1997. Data may not add up to values of totals, due to required regulatory rounding.

Table 4.10-3. Emissions from Operation of + 1 CVN - 4 AOEs at PSNS Bremerton.

-4 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL BREM + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitor Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	(97,931)			(16,433)	(6,826)					(8)			(149,397)	(270,595)	(135.3)	(135.31)
SOx	(115,812)			(71)	(449)					(0)				(116,331)	(58.2)	(58.17)
CO	(8,596)			(4,086)	(1,471)					(1)			(1,112,055)	(1,126,209)	(563.1)	(563.11)
PM	(19,641)	(9)		(1,621)	(446)					(0)			(1,033)	(22,750)	(11.4)	(11.38)
VOC	(4,238)		(253)	(690)	(651)	(947)	(2,528)	(10,564)		(0)	(3,661)		(125,627)	(149,160)	(74.6)	(76.26)
1 CVN	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL BREM + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitor Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx				12,299	16,320					4		244	144,834	173,701	86.9	86.87
SOx				53	1,080					0		16		1,149	0.6	0.57
CO				3,059	3,540					1		53	1,072,505	1,079,157	539.6	539.58
PM		5		1,213	1,160					0		15	1,002	3,394	1.7	1.70
VOC			127	516	660	1,421	1,264	5,282		0	5,021	23	121,928	136,242	68.1	70.88
Net Change	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL BREM + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitor Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	(97,931)			(4,134)	9,494					(4)		244	(4,563)	(96,894)	(48.4)	(48.44)
SOx	(115,812)			(18)	631					(0)		16	-	(115,182)	(57.6)	(57.59)
CO	(8,596)			(1,027)	2,069					(1)		53	(39,550)	(47,051)	(23.5)	(23.52)
PM	(19,641)	(4)		(408)	714					(0)		15	(31)	(19,356)	(9.7)	(9.68)
VOC	(4,238)		(126)	(174)	9	474	(1,264)	(5,282)		(0)	1,360	23	(3,699)	(12,918)	(6.5)	(5.37)

Notes: (1) Data for most emission source categories obtained from Table 5.10-3, Volume 5 (EFA Northwest Environmental Technical Department 1995 and 1997).

(2) Data for calculation of AOE power plant and onboard generator operations provided by NS Seattle.

(3) GSE data obtained from GSE AIRPAC Everett.

Table 4.10-4. Emissions from Operation of + 1 CVN - 4 AOEs at FSC Equivalent at PSNS Bremerton.

-4 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers		Janitoria Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks			Lb/Yr	Ton/Yr
NOx				(25)										(25)	-0.01
SOx				0										-	0.00
CO				(5)										(5)	0.00
PM				(3)										(3)	0.00
VOC				(2)		(395)			362		(3,317)			(3,352)	-1.68

1 CVN	Emissions (Pounds per Year)													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers		Janitoria Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks			Lb/Yr	Ton/Yr
NOx				49										49	0.02
SOx				0										0	0.00
CO				10										10	0.01
PM				6										6	0.00
VOC				3		474			496		4,549			5,522	2.76

Net Change	Emissions (Pounds per Year)													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers		Janitoria Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks			Lb/Yr	Ton/Yr
NOx				24										24	0.01
SOx				0										0	0.00
CO				5										5	0.00
PM				3										3	0.00
VOC				1		79			134		1,232			2,170	1.09

Table 4.10-5. Emissions from Operation of the No Construction Alternative = -2 AOEs and + 1 CVN at PSNS Bremerton.

-2 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL BREM + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	(20,879)			(8,216)	(506)					(4)			(103,790)	(133,395)	(66.7)	(66.70)
SOx	(59,995)			(35)	(33)					(0)				(60,064)	(30.0)	(30.03)
CO	(3,317)			(2,043)	(109)					(1)			(772,571)	(778,041)	(389.0)	(389.02)
PM	(12,907)	(5)		(810)	(33)					(0)			(718)	(14,472)	(7.2)	(7.24)
VOC	(2,357)		(127)	(345)	(48)	(474)	(1,264)	(5,282)		(0)	(1,831)		(87,276)	(99,004)	(49.5)	(50.52)
1 CVN	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL BREM + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx				12,299	16,320					4		244	144,834	173,701	86.85	86.87
SOx				53	1,080					0		16		1,149	0.57	0.57
CO				3,059	3,540					1		53	1,072,505	1,079,157	539.58	539.58
PM		5		1,213	1,160					0		15	1,002	3,394	1.70	1.70
VOC			127	516	660	1,421	1,264	5,282		0	5,021	23	121,928	136,242	68.12	70.88
Net Change	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL BREM + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	(20,879)			4,083	15,814							244	41,044	40,305	20.15	20.17
SOx	(59,995)			18	1,047							16	-	(58,915)	(29.46)	(29.46)
CO	(3,317)			1,016	3,431							53	299,935	301,117	150.56	150.56
PM	(12,907)	0		402	1,127							15	284	(11,078)	(5.54)	(5.54)
VOC	(2,357)		0	171	612	947		0			3,190	23	34,652	37,238	18.62	20.36

Notes: (1) Data for most emission source categories obtained from Table 5.10-3, Volume 5 (EFA Northwest Environmental Technical Department 1995 and 1997).

(2) Data for calculation of AOE power plant and onboard generator operations provided by NS Seattle.

(3) GSE data obtained from GSE AIRPAC Everett.

Table 4.10-6. Emissions from Operation of -2 AOEs and + 1 CVN at FSC Equivalent at PSNS Bremerton.

-2 AOEs	Emissions (Pounds per Year)												
		Abr Blasting	OWPF	NG Boilers		Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles
NOx				(13)									
SOx				0									
CO				(3)									
PM				(2)									
VOC				(1)		(198)			(181)		(1,659)		
1 CVN	Emissions (Pounds per Year)												
		Abr Blasting	OWPF	NG Boilers		Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles
NOx				49									
SOx				-									
CO				10									
PM				6									
VOC				3		474			496		4,549		
Net Change	Emissions (Pounds per Year)												
		Abr Blasting	OWPF	NG Boilers		Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles
NOx				37									
SOx				-									
CO				8									
PM				5									
VOC				2		276			315		2,890		

Table 4.10-7. Boiler- and Gas Turbine-powered AOE Annual Operational Data Associated with the Homeporting Project Alternatives.

Vessel Type/ Mode	# of Vessels	# of Units	Hp/ Units	Hours/ Roundtrip	Load Factor	Hp-Hrs/ Roundtrip	Annual Roundtrips	Fuel Use/ Roundtrip	Annual Fuel Usage (1)
Boiler - Maneuver	2	4		1	0.44		40	1,696	67,840
Boiler - Idle	2	4		25	0.20		40	19,250	770,000
Turbine - Man.	2	4	25,000	2	0.46	184,000	40		7,360,000
Turbine - Ilde	2	4	25,000	2	0.40	160,000	40		6,400,000

Notes: (1) For turbine vessel, represents annual Hp-Hrs.

(2) Boiler vessel idle and maneuver hourly fuel usages are 385 and 848 gallons, respectively (COMNAV Surface Group PacNW 1998).

Table 4.10-8. AOE Onboard Generator Annual Operational Data

Operating Mode	# of Vessels	# of Units	Hp/ Units		Load Factor		Annual Hours		Annual Fuel Usage
Boiler Vessel	2	1	1,341		0.25		24		837
GT Vessel	2	5	3,353		0.25		24		10,461

4.10-9. Emissions Factors for AOE Onboard Sources.

Operating Mode	% Sulfur in Fuel	Emission Factors (Lbs/1000 Gal)(1)						Source
		VOC	CO	NOx	SOx	PM	PM10	
Boiler - Maneuver	0.5	0.7	3.5	55.8	78.5	20.0	19.2	(2)
Boiler - Idle	0.5	3.0	4.0	22.2	71.0	15.0	14.4	(2)
Gas Turbines		0.1	0.2	2.5	1.8	0.2	0.2	(3)
Generators	0.3	57.6	130.2	604.2	39.7	39.5	37.9	(4)

Notes: (1) Grams/Hp-Hr for gas turbine vessels.

(2) (BAH 1991).

(3) AP-42, Volume I, section 3.1 (EPA 1995).

(4) AP-42, Volume I, Table 3.3-1 (EPA 1995).

4.10-10. Annual Emissions for AOE Operations at Berth - CVN Homeporting.

Activity	Pounds					
	VOC	CO	NOx	SOx	PM	PM10
Boiler Vessels - Maneuver	47	237	3,785	5,325	1,357	1,303
Boiler Vessels - Idle	2,310	3,080	17,094	54,670	11,550	11,088
Turbine Vessels - Maneuver	1,006	2,823	41,213	29,855	3,602	3,458
Turbine Vessels - Ilde	875	2,455	35,838	25,961	3,132	3,007
Boiler Generators	48	109	506	33	33	32
Turbine Generators	603	1,362	6,321	415	413	397
AOE Subtotal	**4,238**	**8,596**	**97,931**	**115,812**	**19,641**	**18,856**
AOE - Tons	**2.12**	**4.30**	**48.97**	**57.91**	**9.82**	**9.43**
Gens Subtotal	**651**	**1,471**	**6,826**	**449**	**446**	**428**
Gens - Tons	**0.33**	**0.74**	**3.41**	**0.22**	**0.22**	**0.21**

Table 4.10-11. Emission Source Data for Operation of GSE for 1 CVN at Berth.

Emission Source	*Power Rating (Hp)*	*Load Factor*	*Number Active*	*Annual Equip-Hrs*	*Annual Hp-Hrs*	*Annual Fuel Use (Gal)*
Assorted GSE	80	0.25	30	12	7,200	403

(1) GSE operational data for a CVN obtained from GSE AIRPAC NS Everett.

Table 4.10-12. Emission Factors for GSE.

Emission Source	*Fuel Type*	*Emission Factors (Lbs/1000 Gallons) (1)*					
		VOC	*CO*	*NOx*	*SOx*	*PM*	*PM10*
GSE	D	57.6	130.2	604.2	39.7	39.5	37.9

(1) AP-42, Volume I, Table 3.3-1 (EPA 1995).

Table 4.10-13. Annual GSE Emissions from 1 CVN while at Port.

Emission Source	*Pounds per Year*					
	VOC	*CO*	*NOx*	*SOx*	*PM*	*PM10*
GSE	23	52	244	16	16	15

Table 4.10-14. ADT Composite MOBILE 5.0a VOC Emission Factors - Year 2000

	5 MPH			*25 MPH*			*55 MPH*			*Composite*
Mode	*Winter*	*Summer*	*% Time*	*Winter*	*Summer*	*% Time*	*Winter*	*Summer*	*% Time*	*Grams/Mile*
Composite Fleet	9.18	8.45	0.05	2.62	2.39	0.55	1.58	1.49	0.40	2.43

Table 4.10-15. ADT Composite MOBILE 5.0a CO Emission Factors - Year 2000.

	5 MPH			*25 MPH*			*55 MPH*			*Composite*
Mode	*Winter*	*Summer*	*% Time*	*Winter*	*Summer*	*% Time*	*Winter*	*Summer*	*% Time*	*Grams/Mile*
Composite Fleet	95.52	65.98	0.05	27.10	18.54	0.55	14.62	10.10	0.40	21.53

Table 4.10-16. ADT Composite MOBILE 5.0a NOx Emission Factors - Year 2000.

	5 MPH			*25 MPH*			*55 MPH*			*Composite*
Mode	*Winter*	*Summer*	*% Time*	*Winter*	*Summer*	*% Time*	*Winter*	*Summer*	*% Time*	*Grams/Mile*
Composite Fleet	3.52	3.11	0.05	2.72	2.36	0.55	3.56	3.09	0.40	2.89

Table 4.10-17. Vehicle Miles Travelled Associated with the Bremerton Alternative Components.

Project Scenario (1)	*Week-day ADT*	*Week-end ADT(2)*	*Annual ADT*	*Miles/ Trip*	*Total Annual Miles*
-4 AOEs (3)					
Berthed	(5,220)	(1,044)	(778,824)	12.7	(9,891,065)
AOE Crew Dependents (4)	(12,361)	(12,361)	(4,511,765)	3.0	(13,535,295)
-2 AOEs (3)					
Berthed	(3,625)	(725)	(540,850)	12.7	(6,868,795)
AOE Crew Dependents (4)	(8,590)	(8,590)	(3,135,350)	3.0	(9,406,050)
+1 CVN (5)					
Berthed	4,660	932	824,820	12.7	10,475,214
AOE Crew Dependents (4)	11,050	11,050	4,033,250	3.0	12,099,750
Onbase Motorpool Mileage (6)	NA	NA	NA	NA	150,000

(1) The AOE project scenarios includes the elimination of 2 CGNs = -1740/-4120 crew/dependent ADT from the project region.

(2) Week-end ADT for berthed CVN assumed to be 20 percent of week-day estimates.

(3) Annual berthing of 186 days assumed for an AOE. The -2AOE project scenario includes -2AOE1 vessels = 1300 total crew.

(4) Crew dependent trips would occur off-base. Percentage of crew that live offbase assumed to be the same for all vessel types.

(5) Maximum annual berthing of 229 days for a CVN would occur in association with a PIA cycle.

(6) (USN Public Works, NAVSTA Everett 1998).

Table 4.10-18. Annual Vehicle Emissions for Bremerton Alternatives.

Project Scenario	*Pounds per Year*		
	VOC	*CO*	*NOx*
-4 AOEs	(125,627)	(1,112,055)	(149,397)
-2 AOEs	(87,276)	(772,571)	(103,790)
+1 CVN	121,928	1,072,505	144,834
-2 CGNs	(40,281)	(356,571)	(47,903)
-4 AOEs Tons/Yr	**(62.81)**	**(556.03)**	**(74.70)**
-2 AOEs Tons/Yr	**(43.64)**	**(386.29)**	**(51.89)**
+1 CVN Tons/Yr	**60.96**	**536.25**	**72.42**
-2 CGNs Tons/Yr	**(20.14)**	**(178.29)**	**(23.95)**

Table 4.10-19. Annual Construction Emissions for Homeporting 1 CVN at PSNS Bremerton.

	Tons per Year				
Year/Construction Activity	*VOC*	*CO*	*NOx*	*SOx*	*PM10*
Year 1					
Dredging	2.42	13.64	73.05	8.88	1.84
Truck Transport to Upland Site	0.15	0.83	1.25	0.05	0.00
Annual Total	**2.57**	**14.48**	**74.31**	**8.93**	**1.85**

Notes: (1) Dredging emissions based on a totral dredging volume of 425,000 cubic yards (cy).
(2) Based on an upland disposal of 117,000 cy and 15 cy/truck.

Table 4.10-20. Emission Source Data for Dredging Action at PSNS Bremerton.

Construction Activity/Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Dredging(1)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	24	128	94,003
Dredge - Main Generator	900	0.50	1	450	23.0	24	128	70,502
Dredge - Deck Generator	240	0.60	1	144	7.3	5	128	4,700
Tug Boat	800	0.20	1	160	8.0	4	128	4,096
Disposal to Elliot Site (2)								
Tug Boat	2,200	0.60	1	1,320	66.0	17.0	128	143,616

Notes: (1) Based on a daily dredging rate of 3,333 cubic yards (cy), or 4,000 cy with a 1.2 bulk factor. Total dredging volume would be 425,000 cy, or 510,000 cy with a 1.2 bulk factor.
(2) Based on a daily disposal rate of 4,000 cy (bulked), or two barge loads. Total disposal volume of 370,000 cy (bulked). Round trip distance to the Elliot site would be 42 miles and an average speed of 5 mph.

Table 4.10-21. Emission Factors for Dredging/Disposal Activities at PSNS Bremerton - CVN Homeporting.

	Fuel	*Pounds/1000 Gallons (1)*						
Equipment Type	*Type*	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*	*Source*
Stationary Engines >600 Hp	D	11.1	111.0	424.8	39.5	13.6	13.3	(1)
Stationary Engines <600 Hp	D	43.3	129.3	600.2	39.5	42.2	41.4	(2)
Tug Boats	D	19.0	57.0	419.0	75.0	9.0	8.8	(3)

Notes: (1) AP-42, Table 3.4-1, Vol. I (EPA 1996).
(2) AP-42, Table 3.3-1, Vol. I (EPA 1996).
(3) Lloyd's Register of Shipping, London 1990, 1993, and 1995. From Acurex Env. Corp. 1996.

Table 4.10-22. Emissions for Dredging Action at PSNS Brementon - CVN Homeporting.

	Total Tons					
Construction Activity/Equipment Type	*VOC*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Dredging						
Dredge - Main Hoist (1)	0.5	5.2	20.0	1.9	0.6	0.6
Dredge - Main Generator (1)	0.4	3.9	21.2	1.4	0.5	0.5
Dredge - Deck Generator (1)	0.1	0.3	1.0	0.1	0.1	0.1
Tug Boat	0.0	0.1	0.9	0.2	0.0	0.0
Disposal to Elliot Site						
Tug Boat Transport	1.4	4.1	30.1	5.4	0.6	0.6
Total Emissions - Tons	**2.4**	**13.6**	**73.1**	**8.9**	**1.9**	**1.8**

Table 4.10-23. ADT Composite MOBILE 5.0a Heavy-Duty Diesel Truck Emission Factors - Year 2000

	5 MPH			*25 MPH*			*55 MPH*			*Composite*
Pollutant	*Winter*	*Summer*	*% Time*	*Winter*	*Summer*	*% Time*	*Winter*	*Summer*	*% Time*	*Grams/Mile*
VOC	4.68	4.60	0.10	1.52	1.99	0.40	1.17	1.10	0.50	1.73
CO	33.12	32.87	0.10	7.04	9.76	0.40	6.00	6.19	0.50	9.71
NOx	21.56	20.90	0.10	11.98	12.25	0.40	14.41	15.96	0.50	14.56

Table 4.10-24. Vehicle Miles Travelled for Upland Disposal at Bremerton.

Project Scenario	*Annual ADT*	*Miles/ Trip*	*Total Annual Miles*
Upland Disposal	7,800	10.0	78,000

(1) Truck trips based on an annual disposal rate of 117,000 yd3 and 15 yd3/truck trip.

Table 4.10-25. Annual Truck Emissions for Upland Disposal at Bremerton.

	Pounds per Year		
Project Scenario	*VOC*	*CO*	*NOx*
Upland Disposal	298	1,669	2,504

SECTION 4.13

PSNS SUPPLEMENTAL CULTURAL RESOURCES INFORMATION

SECTION 4.13

PSNS BREMERTON SUPPLEMENTAL CULTURAL RESOURCES INFORMATION

The cultural resources of PSNS have been extensively studied as a result of previously approved projects. Previously prepared documents, including the DPEIS covering the development of homeporting facilities for AOE-6 class support ships at PSNS (DON 1990), and the PSNS Master Plan (DON 1989), form the basis for the following discussion.

No cultural resources have been documented in the channels to be dredged. While most of the dredge material removed from the turning basins and alongside Piers D and B would be suitable for deep water disposal, some of the dredged material will require on-shore disposal. The following review of existing conditions assumes that all disposal would occur in previously developed landfills, eliminating impacts to archaeological sites. In the event that new on-shore disposal areas are required, the Navy would consult with the Washington State OAHP in accordance with Section 106 of the NHPA.

Human occupation of the State of Washington goes back at least 11,000 years, as documented by recent finds east of the Cascades Range and on the Olympic Peninsula. While early groups appear to have focused on hunting terrestrial game, evidence of increased use of marine resources first appears in sites dating to about 5000 years ago. Many of the traits associated with classic Northwest Coast adaptations, including cedar plank longhouses, appear in sites dating to about 3000 years ago. By this time, Native Americans living in the region had developed a lifeway that focused on marine resources, and they reached a level of social complexity normally only seen amongst groups that relied on agriculture. When the first European explorers arrived in the late 1700s, they found the Kitsap Peninsula to be inhabited by various Salish-speaking groups, including the Suquamish. They ceded ownership of lands around Sinclair Inlet in the Point Eliot Treaty of 1855 (OAHP 1987; Suttles 1990).

Euroamerican settlement of Puget Sound began in the 1830s, but it picked up pace dramatically in the 1850s. Logging quickly became established as the primary industry in Puget Sound (Dodds 1986), and it continues to be an important economic force to the present. Federal use of Sinclair Inlet began in 1891 with the purchase of 190 acres for a naval base, and by 1896, a dry-dock and officer's quarters had been constructed. During the period around World War I, the facility continued to expand in response to the need for a larger Pacific Fleet. Near the beginning of World War II, the shipyard was the premier location for repairing large ships in the Pacific Fleet, and it played a key role in repairing the ships damaged at Pearl Harbor on December 7, 1941. Following the war, some vessels were "mothballed" at PSNS, but many were reactivated for use in the Korean War. Since that time, the base has continued to specialize in the repair and modernization of large vessels (DON 1989).

All of the areas to be affected by this project rest on fill that pushed the original shoreline about 1000 feet farther out into Sinclair Inlet, meaning that the project area cannot contain any in situ prehistoric cultural resources. Areas regarded as having a high potential for archaeological sites along the original shoreline are well outside of the project area.

Four National Historic Districts and one National Historic Landmark have been established at PSNS, and a distance of 1600 feet separates these historic resources from the project area. The oldest of the four districts is Officer's Row, which contains homes dating back to 1896. Structures of nearly equal age are present in the Old Puget Sound Radio Station District, which is immediately north of Officer's Row. The Old Marine Reservation District, which dates to the 1910s, reflects the history of using Marine units to defend the base. The youngest of the historic districts, the Old Naval Hospital, contains structures build from the early 1910s to World War II (DON 1989).

The largest historical resource is the National Historic Landmark associated with the World War II era dry-dock and pier facilities near the southeastern corner of the base. These structures are considered significant because of their association with important events in history, and they have retained much of their original function, maintaining their historical integrity. The base of Pier B is over 1600 feet to the west of the landmark.

Construction of additional homeporting facilities at PSNS Bremerton would not have any consequences for cultural resources.

See Figure 4.13-1 for the location of the project area relative to areas regarded as having a high potential for archaeological sites and Figure 4.13-2 for location of the project area relative to NRHP listed properties.

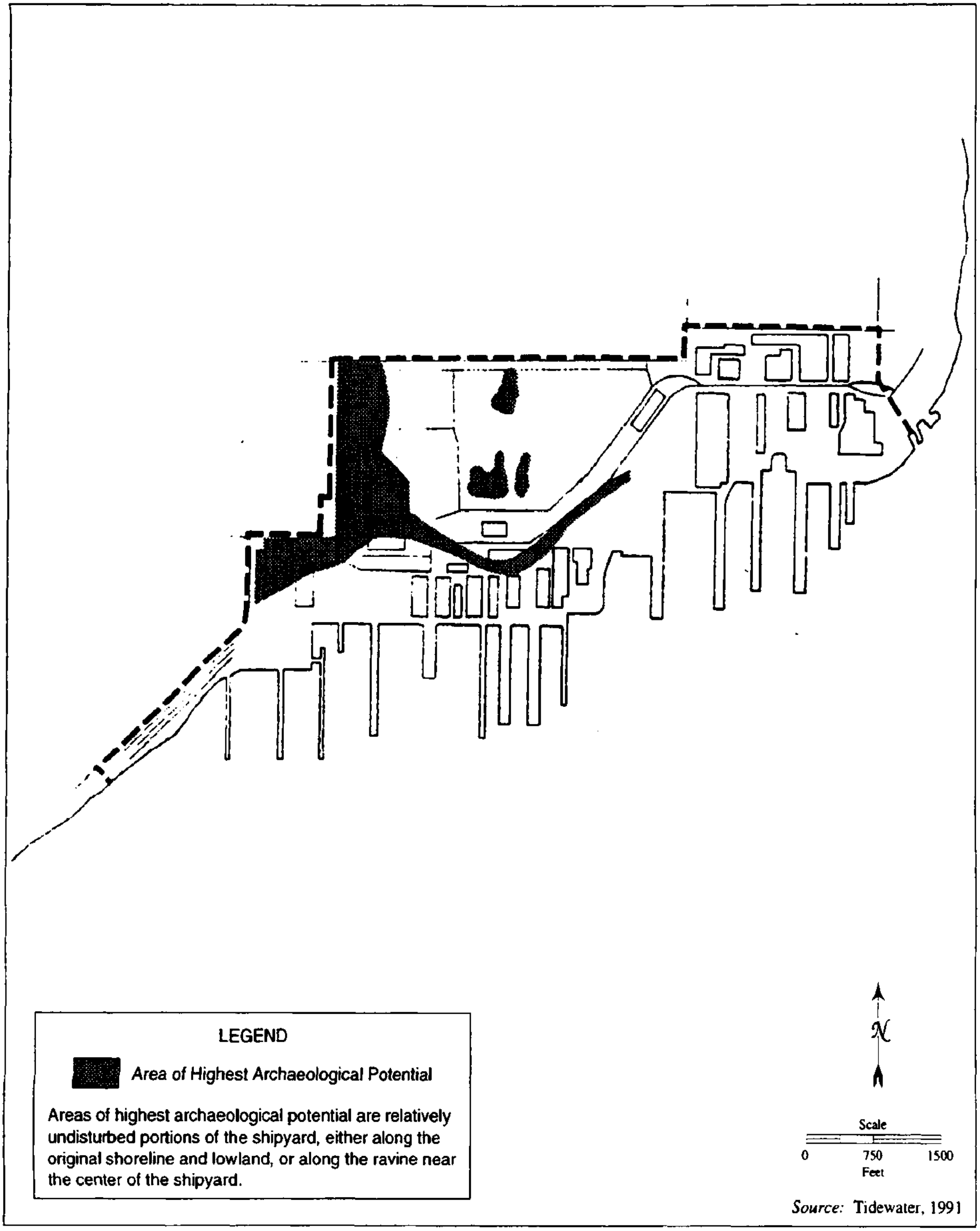

Figure 4.13-1. Location of Project Area Relative to Areas Regarded as Having a High Potential for Archaeological Sites

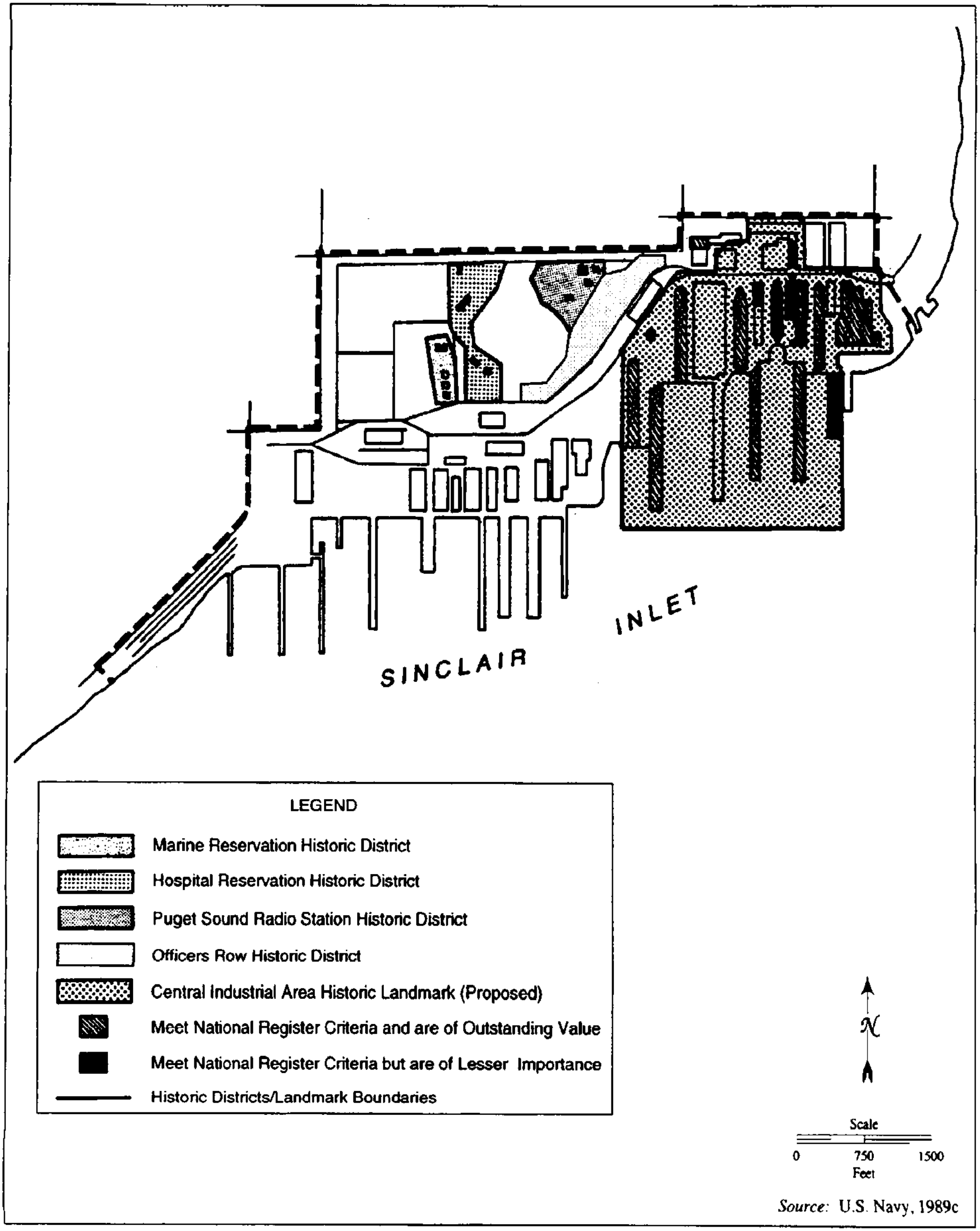

Figure 4.13-2. Location of Project Area Relative to NRHP Listed Properties

SECTION 4.15

PSNS SUPPLEMENTAL HEALTH AND SAFETY INFORMATION

SECTION 4.15
PSNS BREMERTON SUPPLEMENTAL HEALTH AND SAFETY INFORMATION

Centralized control over hazardous material used within PSNS enables more accurate reporting of environmental and safety/health data. One of the goals of this consolidation effort is to improve services by reducing the risks associated with handling and storage of hazardous material and waste. Additionally, the Hazardous Material Control Center (HMCC) provides material to support ongoing projects. The HMCC operates on the "Just-in-Time" concept of delivering hazardous materials directly to the worksites only when the material is needed. Consequently, the need for widespread storage of bulk hazardous materials has been virtually eliminated.

A team of trained Code 910HZ hazardous material handlers deliver the hazardous materials throughout the Shipyard, ensuring material is properly labeled, segregated, and stored. To guarantee that a safe working environment is maintained, this team inspects hazardous material lockers on a periodic basis to ensure continued compliance with the applicable requirements for safe storage of hazardous materials. With less hazardous material stored in the Shipyard and trained personnel delivering to worksites, the chances of spills and unnecessary exposure are greatly reduced.

A Reuse Program has been established to manage excess hazardous materials. Previously, multiple individual organizations across the Shipyard stored quantities of partially used hazardous materials for indefinite periods with the intent to use the excess at a future time. Over time, much of this excess hazardous material became a liability due to improper storage and handling. Prior attempts to establish reuse areas were not successful because no mechanisms were in place to ensure use of the reuse material.

In the current system, workers turn in excess hazardous materials directly to the Shipyard Reuse Store. Additionally, hazardous waste handlers check materials turned in for disposal and divert all potentially reusable hazardous materials to the Reuse Store. The Reuse Store accepts unused as well as partially used containers of commonly used products. All incoming hazardous material is screened to ensure acceptability for use, and is reissued to other users free of charge.

Since one group delivers all material, they check for availability of reuse material first, increasing savings and reducing the amount of hazardous material brought into the Shipyard. Benefits include proper storage and handling of excess hazardous materials, Shipyard-wide visibility of and accessibility to all excess hazardous materials, reduction in material repurchase costs, and reduction in hazardous waste disposal costs.

HAZARDOUS SUBSTANCE SPILL RESPONSE PROCESS

Personnel safety and environment protection are the primary concerns during hazardous substance spill cleanup and recovery actions. As a result, Spill Response Kits are required to be placed at or near areas where oil and hazardous substances are handled. All waterfront Spill Kits are managed by a single organization. Experienced Code 910HZ personnel ensure that an adequate number of Spill Kits are provided at all locations where appropriate. Additionally, weekly inspections verify integrity of spill kit materials, which are replenished as needed. The new Spill Kit program provides an extra degree of protection for production workers by guaranteeing uniform availability of essential spill recovery materials.

HAZARDOUS WASTE PROCESS

Waste unable to be designated as a specific type of hazardous waste, non-hazardous waste, or problem waste at the point of origin is transferred to interim hazardous waste storage while awaiting full designation. A recent process improvement has resulted in a major increase in the amount of waste designated at the point of origin.

A Waste Stream Dictionary is used to designate waste types by associating waste with a unique number that is dependent on work processes and the point of origin. The Waste Stream Dictionary is accessed electronically directly at sites where hazardous waste is generated, so waste can be taken directly to the final storage area for shipment off-site. Reducing the number of times hazardous waste is handled reduces the chances for accidents.

TRAINING

Federal regulations mandate the minimum training required for personnel involved with all aspects of hazardous waste operations and management. However, PSNS has set a higher standard for those Code 910HZ personnel who are secondary responders for spill clean-up. These personnel are also sent to 40 hours of training in Hazardous Waste Operations & Emergency Response (HAZWOPER). HAZWOPER training provides the basic skills needed to evaluate and mitigate an incident involving the release of hazardous materials, including guidelines and principles for protecting the health and safety of at-risk personnel.

HAZARD COMMUNICATION PROGRAM

All workers have the "Right to Know" about the hazards associated with the chemicals they work with or are exposed to in the workplace, and the appropriate protective measures to eliminate or minimize those hazards. The Hazard Communication (HAZCOM) Program was developed and is maintained to ensure that all workers receive this information. PSNS has an ongoing commitment providing hazard communication information to its employees.

The written HAZCOM program (NAVSHIPYDPUGETINST P4110.1A, Chapter 2) is a part of the Hazardous Material Control and Management (HMC&M) Program. The written HAZCOM program is readily available for all workers to read, and provides instructions to ensure:

- All Hazardous Material (HM) used at this facility is listed on the Shipyard Authorized Use List.
- All persons routinely working or coming in contact with HM receive training on the hazardous properties of the HM and the precautionary measures needed for protection from those hazards.
- Only HM with an assigned Shipyard Material safety Data Sheet (MSDS) number is used at this facility.

- An MSDS is readily accessible for every HM in the Shipyard via the Code 910HZ service.
- Manufacturer's labels listing the hazards of the HM are left intact on all containers.
- All HM containers are marked, labeled or tagged with a supplemental diamond hazard label.

Final Environmental Impact Statement for

Developing Homeporting Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet

Coronado, California • Bremerton, Washington
Everett, Washington • Pearl Harbor, Hawaii

VOLUME 5

NAVSTA Everett
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SECTION 5.1

NAVSTA EVERETT SUPPLEMENTAL TOPOGRAPHY, GEOLOGY, AND SOILS INFORMATION

SECTION 5.1
NAVSTA EVERETT SUPPLEMENTAL TOPOGRAPHY, GEOLOGY, AND SOILS INFORMATION

GEOLOGIC HAZARDS

Refer to Volume 4, section 4.1 for a general discussion of seismicity in the Pacific Northwest.

The following was derived directly from HartCrowser (1986):

The geology at the Port of Everett site generally comprises recent, fine-grained cohesionless soils that are relatively loose in consistency. During past seismic events, port facilities located on similar soils have been particularly susceptible to liquefaction. This susceptibility is well documented in a National Science Foundation study involving an assessment of the historical impact of earthquakes on port facilities (Werner and Hung 1982). The Werner and Hung study included a review of world-wide data on earthquake damage to ports. One of the primary conclusions from that study, which is also considered appropriate for the Port of Everett area, is stated below:

> By far the most significant source of earthquake induced damage to port and harbor facilities has been pore water pressure buildup (liquefaction) in the loose to medium dense, saturated, cohesionless soils that prevail at port and harbor sites. This has led to damage due to excessive lateral pressures applied to quay walls and bulkheads by backfill materials and to liquefaction, localizing sliding, or massive submarine sliding of the site soil materials.

The high susceptibility to liquefaction of geologic materials typically occurring at port facilities is further documented in a National Research Council workshop involving liquefaction of soils during earthquakes (NRC 1985). Considerable evidence of the consequences of partial or total liquefaction, such as flow failures, lateral spreads, loss of bearing capacity, buoyant rise of buried structures, ground settlement and failure of retaining walls was documented during this workshop. This documentation included pore water pressures recorded during partial liquefaction of a dredge fill island, located in the Tokyo Bay area.

The two major Puget Sound earthquakes of recent history (1949 and 1965) also resulted in damage to some Puget Sound port facilities. Notable damage occurred to Piers No. 15 and 16 on Harbor Island in Seattle during the 1965 earthquake. These facilities shifted toward the water about 1 foot, likely associated with soil liquefaction. The port area of Olympia also experienced ground-failure damage. The damage was not catastrophic, but did require repair.

In cases of severe liquefaction, impacts have included loss of foundation support, slope failure, and settlement. In the case of less severe liquefaction, the impacts often include limited vertical and/or horizontal displacements. The observed movements attributed to liquefaction at Puget Sound ports have included localized lateral movement of bulkheads and associated ground settlement. These movements apparently did not result in catastrophic failures, but did result in some structural damage.

During a major earthquake in the Everett area, it is conceivable that site liquefaction could be significant enough to result in loss of foundation support, slope failure, and settlement at the home port site. Determination of the potential for such failures will depend on the behavior of the soil in a liquefied state. This behavior is related to the state of the soil relative to a given soil in its steady state condition (NRC 1985). If the steady state shear strength is greater than the driving shear stress, little if any reduction in soil strength will occur in a liquefied state (NRC 1985). As soon as these soils begin to deform, pore water pressures decrease from soil dilation resulting in a strength nearly the same as the static soil strength. Soils with steady state shear strengths lower than the driving shear stress can exhibit lower strengths than the static soil strength as a result of liquefaction and, therefore, can undergo catastrophic slope failures or bearing capacity failures. Generally, this latter case involves very loose soils.

A review of file data was performed to determine whether or not large strength loss should be expected for home port soils when in a liquefied state. Blowcounts from SPTs suggest that corrected N-values (N1) will be typically less than 20. Such materials are identified by Seed, Tokimatsu, Harder, and Chung (1984) as having large damage potential, with limiting strains from 20 to 40 percent. Residual strengths for such soils are expected to be less than 500 psf (NRC 1985). This suggests that significant strength loss must be anticipated if extensive liquefaction were to occur.

Results of laboratory strength tests and estimates of in-situ void ratios also suggest that much lower strengths may be observed as a result of extensive liquefaction. Steady state strengths are estimated to range from 100 to 200 psf for in-situ voids ratios. This estimate of steady state strength is based on limited laboratory test data and relatively crude estimates of in-situ voids ratios. Consequently a considerable degree of uncertainty is associated with this estimate.

A loss of strength would affect stability of slopes and would potentially affect bearing capacity of soils. Simplified analyses were conducted to quantify these effects. Results of these analyses are summarized below:

- Factors of safety of slopes will be less than 1.0 when liquefied soils are characterized by residual strengths of 100 to 200 psf. This suggests that large slope movements could occur during a seismic event exceeding 0.1g.

- Pseudo-static procedures indicate slope stability factors of safety on the order of 1.0, using a seismic coefficient of 0.12.

- Bearing capacities of large foundations will be decreased. The amount of bearing capacity decrease will depend on the width of the footing (B) relative to the distance between the footing base and the water table (H). Reductions in bearing capacity will result if B/H is greater than approximately 1.0.

- Axial and lateral capacities of piles within the liquefied zone will be reduced. Lateral capacities in the liquefied zone will be determined by the steady state strength (100 to 200 psf); axial capacities will be controlled by an interface strength, which could approach zero (NRC 1985). This latter condition could result in redistribution of frictional forces along the pile to zones where liquefaction has not occurred. In addition to a reduction of pile capacities, lateral loads could be imposed on the piles due to flow slides, submarine sliding, and lateral spreading associated with liquefaction.

- Settlement of onshore facilities could occur. The magnitude of this settlement can range from less than 1 percent to more than 10 percent of the layer thickness (Lee and Albaisa 1974). Typical amounts of settlement may be less than 0.5 percent of the layer thickness for levels of earthquake-induced shear stress ratio expected at the Homeport site (Pyke, Chan, and Seed 1974). A settlement of 4 to 6 inches could be postulated for the Homeport site using a value of 0.5 percent.

- Liquefaction could also result in increased lateral earth pressure on buried structures below the water table.

REFERENCES

HartCrowser 1986. Geotechnical Engineering Design Report, NAVSTA Puget Sound, Everett, Washington, Contract No. N62474-85-C-5234, Mole and Site Improvements and Utilities, Volume 1-Engineering Studies. Prepared for the Department of the Navy, Naval Facilities Engineering Command, Western Division and Howard Needles Tammen & Bergendoff.

National Research Council (NRC) 1985. Liquefaction of Soils during Earthquakes, Washington, D.C.: National Academy Press.

Pyke, R.M., Chan, C.K. and Seed, H.B. 1974. "Settlement and Liquefaction of Sands under Multi-directional Shaking", Report No. EERC 74-2, Earthquake Engineering Research Center, University of California, Berkeley.

Richter, Charles F. 1958. *Elementary Seismology*. San Francisco, W.H. Freeman and Company.

Seed, H.B., Tokimatsu, K., Harder, L.F., and Chung, R.M. 1984. "The Influence of SPT Procedures in Soil Liquefaction Resistance Evaluations", Report No. UCB/EERC/84/15, Earthquake Engineering Research Center, University of California, Berkeley.

Werner, S.D. and Hung, S.J. 1982. "Seismic Response of Port and Harbor Facilities," R-8122-5395, under NSF Grant No. CEE-8012337, Agbabian Associates.

SECTION 5.2

NAVSTA EVERETT SUPPLEMENTAL MARINE WATER QUALITY INFORMATION

SECTION 5.2

NAVSTA EVERETT SUPPLEMENTAL MARINE WATER QUALITY INFORMATION

SOIL AND GROUNDWATER CONTAMINATION

Industrial development of the present day NAVSTA Everett site began around 1900. The initial industries included a saw mill, shingle mill, and wood products company. This area reached its maximum development in 1945. Wood products manufacturing continued in portions of the present-day station until the acquisition of the property by the Port of Everett in the mid-1970s. Other portions of the property were used for boat storage, fueling, and repair (URS and B&V Waste Science 1992).

The South Mole (harbor breakwater) extending into the Snohomish River channel had been completed at the beginning of World War II. During World War II, a Naval Reserve shipyard was constructed on the mole. The shipyard included a series of docking facilities; dry-dock areas; shipways; and associated storage, fabrication, and assembly structures with supporting facilities including machine, electrical, metal, and paint shops. In 1961, the shipyard was replaced by Western Gear Machinery Company, which specialized in the manufacture of heavy equipment and machinery for the oil drilling industry. Inspections of this area in 1985 found evidence of hazardous chemical spills, polychlorinated biphenyls (PCBs) leakage, stockpiled welding and cutting slag, paint sludge, and stockpiled hydraulic fluid with other chemicals (URS and B&V Waste Science 1992).

In 1989, the Navy purchased the Norton Terminal area and the Pacific Terminal that surrounded the Western Gear Site from the Port of Everett. The Port of Everett had leased the property to Viking Wire Rope Company, Foss Launch and Tug Company, and Dunlap Towing prior to the purchase by the Navy. Operations by these tenants lead to observations made in 1986 of stockpiled sand blast grit, scrap metal, and other debris on the South Mole; spilled oil and paint on the South Mole; and fuel drums in the log yard area. Most of the existing structures had been demolished by the Port of Everett. Using hydraulic fill operation, the upland portion of the property was expanded to its current configuration (URS and B&V Waste Science 1992).

A Preliminary Assessment (PA) was completed February, 1992 (URS and SAIC 1992). Based upon the available data, the Homeport property was considered a medium priority for future site investigation. A summary of the findings of this assessment is provided below:

- Available analytical data indicated that the Homeport site was not excessively contaminated and there was no apparent need for emergency removal actions. Soil contamination detected in 1986 consisted primarily of polycyclic aromatic hydrocarbons (PAHs). Other contaminants detected were compounds commonly associated with lab contamination. Much of the soil contamination appeared to occur randomly with no direct source and may reflect the use of potentially contaminated hydraulic fill material used to expand upland portions of the property or previous unidentified operations. The hydraulic fill has since been covered with 3 to 5 feet of clean fill material placed over the entire site during home port construction. Detected groundwater contaminants consisted primarily of dissolved trace metals and compounds commonly associated with lab contamination. The 1986 data were not validated and contamination of lab blanks reflects a lower degree of confidence for certain reported contaminants (i.e., methylene chloride, acetone, toluene, bis [2-ethylhexyl] phthalate).

- Specific sites where contamination was related to historical activities include the detection of PCBs at Building F and isolated detections of various chlorinated volatile compounds in soils and groundwater at the south mole. PCB material greater than 25 parts per million (ppm) was shipped off site to a permitted disposal facility while low level PCB material (less than 25 ppm) remains buried on site.

- Homeport construction activities have resulted in some site remediation. Placement of 3 to 5 feet of clean fill material over the entire site and future paving of much of the area tends to minimize the potential for direct contact with contaminated soils and limits the infiltration of precipitation. Excavated soils from the south mole that were contaminated with total petroleum hydrocarbons were bioremediated to levels less than 200 ppm and moved off site for disposal at an appropriate facility.

- The discharge of contaminants via shallow groundwater to adjacent marine waters is possible; however, the magnitude and potential impacts of this discharge are undetermined (See Volume 1, section 5.3).

A Screening Site Inspection (SSI) was conducted between September, 1992 and November, 1992 and a Final Screening Site Inspection Report was completed April, 1993. Sampling data collected provided evidence of the presence of chemicals of potential concern in the soil and groundwater. Several compounds/elements were identified above the Model Toxic Control Act (MTCA) cleanup standards which were used for screening. These compounds were diesel, gasoline, other petroleum hydrocarbons (TPHs); arsenic, chromium, lead, lead, manganese, nickel, vanadium, some volatile compounds, and one polychlorinated biphenyl (PCB) — Aroclor 1254. One additional compound, beryllium, was found above MTCA standards but below background levels for the region; therefore, beryllium was eliminated as a chemical of concern. Preliminary regional background data were also used to screen arsenic identified in the soil column, but concentration in excess of the background values were found (URS and B&V Waste Science 1992).

The Final Screening Site Inspection Report concluded that the compounds detected were either at concentrations below screening levels or no exposure pathways were confirmed. It stated that if future conditions or land use change, then these concentrations may need to be re-evaluated. In addition, if it is determined that future studies indicate impacts to the marine environment, terrestrial pathways should be reevaluated (URS and B&V Waste Science 1992).

REFERENCES

URS Consultants, Inc. and Science Applications International Corporation. 1992. Final Preliminary Assessment Naval Station Puget Sound, February 21.

URS Consultants, Inc. and B&V Waste Science and Technology Corporation. 1993. Final Screening Site Inspection Report for the Comprehensive Long-term Environmental Action Navy (CLEAN) Program Northwest Area, April.

SECTION 5.4

NAVSTA EVERETT SUPPLEMENTAL SEDIMENT QUALITY INFORMATION

SECTION 5.4
NAVSTA EVERETT
SUPPLEMENTAL SEDIMENT QUALITY INFORMATION

The data presented in Table 5.4-1 is for sediment samples collected in the vicinity of the planned berthing area on the west side of the Carrier Pier (stations SQ07 and SQ08) and within the Snohomish River in the vicinity of the North Wharf (SQ10). PAHs were the typical organic compounds detected in sediments of NAVSTA Everett.

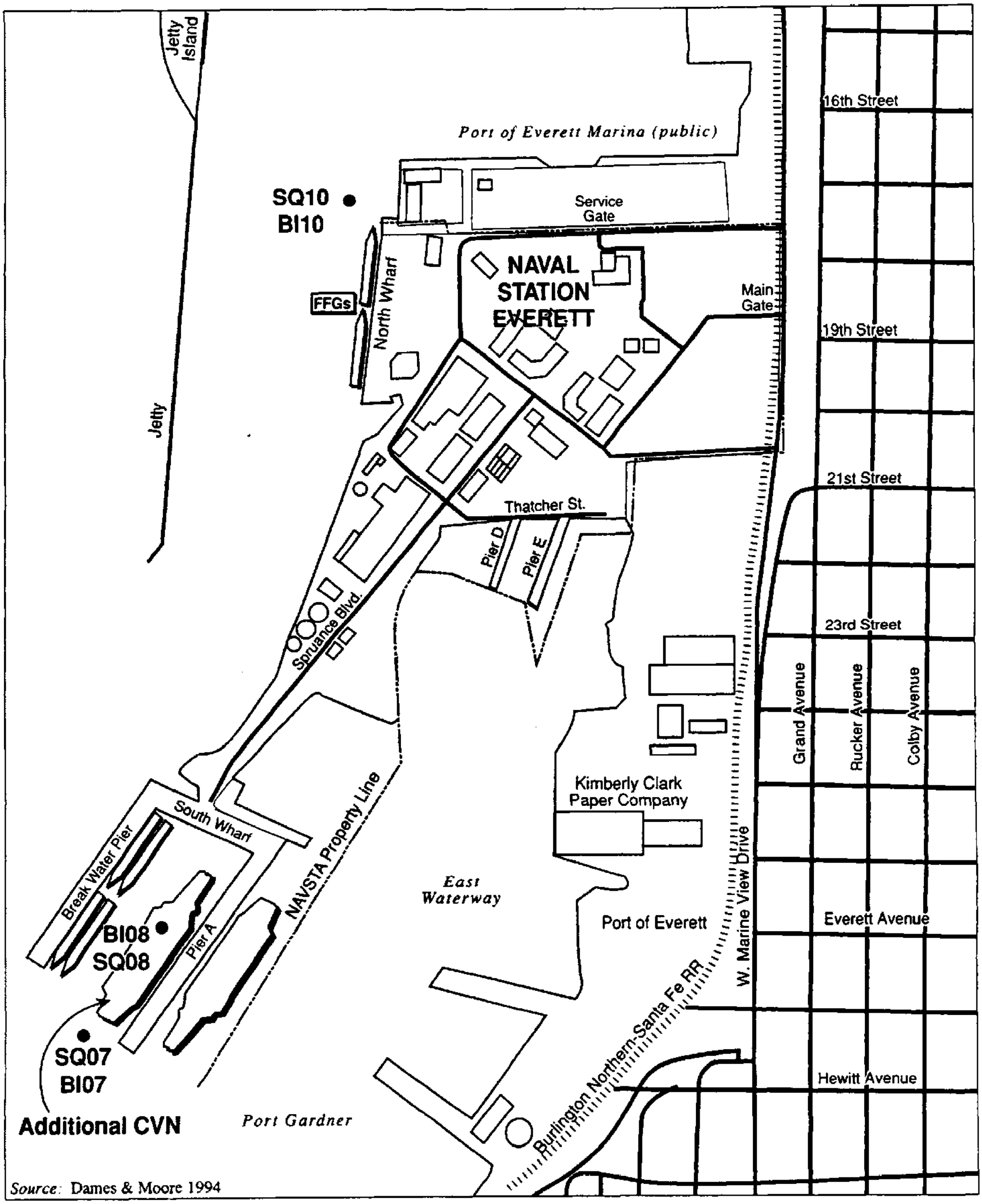
Table 5.4-1. Summary Chemistry for Proposed Dredge Area at NAVSTA Everett

Station	*SQ07*	*SQ08*[1]	*SQ10*
Conventional Parameters			
Total Organic Carbon (%)	1.41	1.32	1.42
Fines (%)	66	70	69
Metals (mg/kg dw)			
Antimony	0.09 UJ	–	–
Arsenic	7.3	9.1	12
Cadmium	0.71 B	0.70 B	0.26 J
Copper	39.5	50.1	44.1
Lead	13	15.2	9.8
Mercury	0.1	0.15	0.07
Nickel	38.4	41.1	44.3
Silver	0.19 B	0.22 B	0.1 B
Zinc	73.1 J	73.6	71.2 J
Organotins (µg/kg dw)			
Tributyltin	14 U	20	14 U
LPAH (µg/kg dw)			
Acenaphthalene	86 J	56	59 U
Acenaphthene	–	165	130 J
Anthracene	70 J	93	39 J
Fluorene	29 J	50	18 J
Naphthalene	79 J	75	110 J
Phenanthrene	170 J	207	87 J
2-Methylnaphthalene	110 J	73	49 J
Total LPAH	544	646	463
HPAH (µg/kg dw)			
Benzo(a)anthracene	77 J	101	25 J
Benzo(a)pyrene	140 J	121	20 J
Benzofluoranthenes	152 J	141	25 J
Benzo(ghi)perylene	110 J	86	190 J
Chrysene	80 J	96	29 J
Dibenzo(a,h)anthracene	90 J	27	39 J
Fluoranthene	540 J	573	200 J
Indeno(1,2,3-cd)pyrene	75 J	52	20 U
Pyrene	390 J	337	110 J
Total HPAH	1650	1530	638
Phthalates and Other B/N (µg/kg dw)			
Bis(2-ethylhexyl)phthalate	88 U	51	47 U
Dibenzofuran	31 U	20	33 U

1 Values represent an average for all detected results of three replicate samples collected at SQ08.
– Data for this parameter was either not detected for all replicates or considered unusable by Dames & Moore (e.g.,Rejected data).
U Undetected value.
J Estimate value.
R Rejected value.
B Below metal quantitation limit.
SL Exceedances Numbers surrounded by a border exceed corresponding PSDDA SL values.
ML Exceedances Numbers surrounded by a border, bold, and shaded exceed corresponding PSDDA ML values.

The highest organic concentrations were reported at SQ08 with the additional detection of bis(2-ethylhexyl)phthalate, dibenzofuran, and tributyltin. The pier's west side would have to be dredged an additional 5 feet to moor supply ships and 10 feet to moor a CVN.

Figure 5.4-1 displays sediment and benthic infauna monitoring locations at NAVSTA Everett.



Source: Dames & Moore 1994

Figure 5.4-1. Sediment and Benthic Infauna Monitoring Locations, NAVSTA Everett

SECTION 5.5

NAVSTA EVERETT SUPPLEMENTAL MARINE BIOLOGY INFORMATION

SECTION 5.5
NAVSTA EVERETT SUPPLEMENTAL MARINE BIOLOGY INFORMATION

Predominant species in Puget Sound include the diatoms *Skeletonema costatum, Chaetoceros constrictus, C. debilis, C. compressus, C. socialis, Nitzschia* sp., *Thalassiosira aestrivales,* and *T. nordenskioldii;* the dinoflagellates *Peridinium* spp., *Gymnodinium* spp., and *Ceratium fusus;* and various other nanoflagellates (DON 1992). Zooplankton abundances generally reflect changes in abundance in phytoplankton. Dominant zooplankton found in Port Gardner included copepods, cladocerans, and other small crustaceans (DON 1992). Some of the dominant zooplankton observed in Port Gardner (based on a single survey) included the copepods *Acartia clausi, Corycaeus affinis, Pseudocalanus minutus, Oithona spinirostris, O. similus,* and *Evadne* sp.; and the tunicates *Appendicularia* sp. and *A. longiremis* (DON 1984).

Salmon species inhabiting the Snohomish River system include chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), pink (*O. gorbuscha*), and chum (*O. keta*) salmon (DON 1992, 1985). The naturally occurring populations of salmon species are augmented by fish released from Tulalip tribal and Washington Department of Fish and Wildlife (WDFW) hatcheries (DON 1994). Other anadromous fish species are steelhead trout (*Salmo gairdnerii*), searun cutthroat trout (*Salmo clarkii*), Dolly Varden char (*Salvelinus malma*), and American shad (*Alosa sapidissima*) (DON 1992, 1985).

Some of the predominant pelagic and demersal fish species observed in and around the East Waterway, during surveys conducted in 1984, were Pacific hake (*Merluccius productus*), walleye pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), Pacific herring (*Clupea harrangus pallasii*), shiner surfperch (*Cymatogaster aggregata*), striped perch (*Embiotoca lateralis*), Pacific tomcod (*Microgadus proximus*), and spiny dogfish (*Squalus acanthias*). Commonly caught demersal fish included English sole (*Parophrys vetulus*), sand sole (*Psettichthys melanostictus*), Pacific sanddab (*Citharichthys sordidus*), and Pacific staghorn sculpin (*Leptocottus armatus*). Pacific staghorn sculpin, Pacific hake, walleye polluck, and copper rockfish (*Sebastes caurinus*) were the dominant species observed on the edge of the Snohomish River channel at the southwest corner of the homeporting site. Prominent species caught in the East Waterway, but not at the river mouth included shiner perch, striped perch, and Pacific tomcod (DON 1992, 1985).

Key bird species that overwinter in the East Waterway include Barrow's goldeneye (*Bucephala islandica*), western grebe (*Aechmophorus occidentalis*), double-crested cormorant (*Phalacrocorax penicillatus*), great blue heron (*Ardea herodias*), red-necked grebe (*Podiceps grisegena*), and mallard (*Anas platyrhynchos*). In addition, Barrow's goldeneye, red-breasted merganser (*Mergus serrator*), pied-billed grebe (*Podilymbus podiceps*), horned grebe (*Podiceps auritus*), marbled murrelet (*Brachyramphus marmoratus*), and ruddyducks (*Oxyura jamaicensis*) overwinter in the protected bays and channels near the Norton Terminal area. Flocks of cormorants, western grebes, and scaups forage in the river channel during winter. Glaucous-winged gulls, mallards, and blue herons are the primary users of the East Waterway during the summer. Many of the birds were observed swimming and resting among the log rafts, boats, and floating debris. Some were observed feeding on mussels and barnacles attached to revetments, dolphins, pilings, and floating docks (DON 1992; DON 1985, Appendix W).

In addition to the waterbirds, bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons (*Falco peregrinus anatum*) have also been observed in the vicinity of the Everett home port site. During the spring, immature bald eagles perch and forage at Jetty Island. They have also been observed foraging in the East Waterway. Similarly, peregrine falcons forage in the vicinity of the homeport site, the Snohomish River estuary and Jetty Island (DON 1992).

SECTION 5.9

NAVSTA EVERETT
SUPPLEMENTAL TRAFFIC INFORMATION

SECTION 5.9
NAVSTA EVERETT SUPPLEMENTAL TRAFFIC INFORMATION

Table 5.9-5 provides impacts on daily traffic volumes from the addition of 1 additional CVN at NAVSTA Everett. The impacts of the additional traffic on intersection levels of service are shown on Table 5.9-6. Tables 5.9-7 and 5.9-8 address impacts of no additional CVN and two additional AOEs at NAVSTA Everett.

Table 5.9-5 Impact on Daily Traffic Volumes 1 Additional CVN at NAVSTA Everett			
Roadway/Location	**Baseline Traffic Volume & V/C**	**Project Traffic**	**Traffic Volume w/ Project & V/C**
Interstate 5 North of US Route 2 South of US Route 2	 118,000 - 0.98 151,000 - 0.94	 400 600	 118,400 - 0.99 151,600 - 0.95
Everett Avenue	19,000 - 0.48	420	19,420 - 0.49
Hewitt Avenue	19,000 - 0.48	420	19,420 - 0.49
Pacific Avenue	17,700 - 0.44	1,050	18,750 - 0.47
W. Marine View Drive	18,800 - 0.47	2,300	21,100 - 0.53
E. Marine View Drive	15,400 - 0.39	1,880	17,300 - 1.05
Rucker Avenue	28,700 - 0.72	420	29,120 - 0.45
Broadway	31,400 - 0.79	420	31,820 - 0.80

Table 5.9-6 Impact on Intersection Levels of Service 1 Additional CVN at NAVSTA Everett		
Intersection	**PM Peak Hour Delay (sec) - V/C Ratio -LOS**	
	Without Project	**With Project**
Marine View/NAVSTA Main Gate	11.6 - 0.63 - B	18.1 - 0.89 - C
Marine View/18th	8.7 - 0.42 - B	11.8 - 0.61 - B
Marine View/Everett	7.3 - 0.31 - B	8.2 - 0.45 - B
Marine View/Hewitt	6.5 - 0.40 - B	6.5 - 0.57 - B
Marine View/Pacific	12.5 - 0.61 - B	14.0 - 0.62 - B
Rucker/Everett	24.9 - 0.91 - C	24.7 - 0.94 - C
Rucker/Hewitt	10.9 - 0.74 - B	11.9 - 0.78 - B
Rucker/Pacific	28.3 - 0.99 - D	46.5 - 1.08 - E
Broadway/Everett	49.1 - 0.97 - E	49.0 - 0.97 - E
Broadway/Hewitt	47.1 - 1.03 - E	47.4 - 1.04 - E
Broadway/Pacific	38.6 - 0.95 - D	39.9 - 0.97 - D

Table 5.9-7 Impact on Daily Traffic Volumes No Additional CVN, 2 Additional AOEs at NAVSTA Everett			
Roadway/Location	**Baseline Traffic Volume & V/C**	**Project Traffic**	**Traffic Volume w/ Project & V/C**
Interstate 5			
North of US Route 2	118,000 - 0.98	160	118,160 - 0.98
South of US Route 2	151,000 - 0.94	230	151,230 - 0.95
Everett Avenue	19,000 - 0.48	160	19,160 - 0.48
Hewitt Avenue	19,000 - 0.48	160	19,160 - 0.48
Pacific Avenue	17,700 - 0.44	390	18,100 - 0.45
W. Marine View Drive	18,800 - 0.47	860	19,660 - 0.49
E. Marine View Drive	15,400 - 0.39	700	16,100 - 0.40
Rucker Avenue	28,700 - 0.72	160	28,860 - 0.72
Broadway	31,400 - 0.79	160	31,560 - 0.79

Table 5.9-8 Impact on Intersection Levels of Service No Additional CVN, 2 Additional AOEs at NAVSTA Everett		
Intersection	**PM Peak Hour Delay (sec) - V/C Ratio -LOS**	
	Without Project	**With Project**
Marine View/NAVSTA Main Gate	11.6 - 0.63 - B	12.6 - 0.73 - B
Marine View/18th	8.7 - 0.42 - B	9.3 - 0.49 - B
Marine View/Everett	7.3 - 0.31 - B	7.4 - 0.36 - B
Marine View/Hewitt	6.5 - 0.40 - B	6.4 - 0.46 - B
Marine View/Pacific	12.5 - 0.61 - B	12.9 - 0.61 - B
Rucker/Everett	24.9 - 0.91 - C	24.8 - 0.92 - C
Rucker/Hewitt	10.9 - 0.74 - B	11.2 - 0.75 - B
Rucker/Pacific	28.3 - 0.99 - D	32.8 - 0.98 - D
Broadway/Everett	49.1 - 0.97 - E	49.0 - 0.97 - E
Broadway/Hewitt	47.1 - 1.03 - E	47.1 - 1.03 - E
Broadway/Pacific	38.6 - 0.95 - D	38.8 - 0.96 - D

SECTION 5.10

NAVSTA EVERETT SUPPLEMENTAL AIR QUALITY INFORMATION

SECTION 5.10

NAVSTA EVERETT

SUPPLEMENTAL AIR QUALITY INFORMATION

Table 5.10-1 provides the national and Washington state ambient air quality standards. Tables 5.10-2 and -3 present the total stationary and area source emissions that occurred at NAVSTA Everett and the Family Support Complex (FSC) in 1995 and an estimate of projected emissions at these facilities that would occur in 1997 with the presence of a CVN (Naval Facilities Engineering Command 1995 and 1997). These data also present the incremental emissions from the homeporting of one CVN at the facility.

Tables 5.10-4 through 5.10-18 present calculations used to estimate source emissions for all alternative components at NAVSTA Everett.

Table 5.10-1. National and Washington Ambient Air Quality Standards

Pollutant	Averaging Time	Washington Standards	National Standards [a] Primary [b,c]	National Standards [a] Secondary [b,d]
Ozone	8-hour	—	0.08 ppm (160 ug/m³)	Same as primary
	1-hour	0.12 ppm (235 μg/m³	0.12 ppm (235 μg/m³)	Same as primary
Carbon monoxide	8-hour	9 ppm (10 mg/m³)	9 ppm (10 mg/m³)	—
	1-hour	35 ppm (40 mg/m³)	35 ppm (40 mg/m³)	—
Nitrogen dioxide	Annual	0.053 ppm (100 μg/m³)	0.053 ppm (100 μg/m³)	Same as primary
	1-hour	—	—	—
Sulfur dioxide	Annual	0.02 ppm (53 μg/m³)	0.03 ppm (80 μg/m³)	—
	24-hour	0.10 ppm (261 μg/m³)	0.14 ppm (365 μg/m³)	—
	3-hour	—	—	0.5 ppm (1,300 μg/m³)
	1-hour	0.25[e]/0.40 ppm	—	—
PM10	Annual (arithmetic)	50 μg/m³	50 μg/m³	Same as primary
	Annual (geometric)	—	—	—
	24-hour	150 μg/m³	150 μg/m³	Same as primary
PM2.5	Annual (arithmetic)	—	15 μg/m³	Same as primary
	24-hour	—	65 μg/m³	Same as primary
Lead	Calendar quarter	1.5 μg/m³	1.5 μg/m³	Same as primary
	30-day average	—	—	—

Notes:
(a) Standards, other than for ozone and those based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.
(b) Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parenthesis.
(c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each state must attain the primary standards no later than 3 years after that states implementation plan is approved by the EPA.
(d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
(e) Not to be exceeded more than twice in 7 consecutive days.

Table 5.10-2. 1995 and 1997 NS Everett Emissions Inventory and Estimate of Operational Emissions for 1 CVN at NS Everett.

1995 Inventory	Emissions (Pounds per Year)												
	Abr Blasting	OWPF	NG Boilers	Em Gens Onshore		Fiber-glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	
NOx			1,139	504							10		
SOx			7	33							0		
CO			239	109							2		
PM	2		137	37							0		
VOC		63	66	41		3	1,579	632	2,641	514	0	1	
1997 Projection	Emissions (Pounds per Year)												
	Abr Blasting	OWPF	NG Boilers	Em Gens Onshore		Fiber-glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	
NOx			39,520	504							23		
SOx			282	33							0		
CO			10,010	109							4		
PM	18		3,919	37							1		
VOC		4,683	1,667	41		3	4,736	5,361	21,130	4,112	1	10,460	
1 CVN Increment	Emissions (Pounds per Year)												
	Abr Blasting	OWPF	NG Boilers	Em Gens Onshore	Em Gens Onboard	Fiber-glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE
NOx			12,299	-	16,320					-	4		244
SOx			53	-	1,080					-	0		16
CO			3,059	-	3,540					-	1		53
PM	5		1,213	-	1,160					-	0		15
VOC		127	516	-	660		1,421	1,264	5,282	-	0	5,021	23

Notes: (1) 1995 and 1997 emission inventories derived by EFA Northwest Environmental Technical Department (1995 and 1997).

(2) 1995 Janitorial supplies VOC revised to one third of 1997 value, since 1997 value is 3 times actual.

(3) 95 VOC for OWPF not calculated for 1995, but 1997 estimated to be 8 times the value of 1995.

(4) Emissions for emergency generators onboard a CVN obtained from SD EIS (DON 1995).

(5) GSE operational data for a CVN obtained from Chief Rickabaugh of GSE AIRPAC Everett.

Table 5.10-3. 1995 and 1997 NS Everett Emissions Inventory and Estimate of Operational Emissions for 1 CVN at the FSC.

1995 Inventory	*Emissions (Pounds per Year)*														TOTAL EMISSIONS	
	Abr Blasting	OWPF	NG Boilers	Em Gens		Fiber-glas	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx			98	336											434	0.22
SOx			1	22											23	0.01
CO			21	73											93	0.05
PM			12	25											36	0.02
VOC			6	27			526			345		-			904	0.45
1997 Inventory	*Emissions (Pounds per Year)*														**TOTAL EMISSIONS**	
	Abr Blasting	**OWPF**	**NG Boilers**	**Em Gens**		**Fiber-glas**	**Janitorial Supplies**	**Misc. VOC**	**Paints & Solvents**	**Parts Cleaner**	**Propane Equip**	**Fuel Tanks**		**Vehicles**	**Lb/Yr**	**Ton/Yr**
NOx			147	504											651	0.33
SOx			1	33											34	0.02
CO			31	109											140	0.07
PM			18	37											55	0.03
VOC			9	41			1,579			1,034		9,478			12,140	6.07
1 CVN Inventory	*Emissions (Pounds per Year)*														**TOTAL EMISSIONS**	
	Abr Blasting	**OWPF**	**NG Boilers**	**Em Gens**		**Fiber-glas**	**Janitorial Supplies**	**Misc. VOC**	**Paints & Solvents**	**Parts Cleaner**	**Propane Equip**	**Fuel Tanks**		**Vehicles**	**Lb/Yr**	**Ton/Yr**
NOx			49	-											49	0.02
SOx			0	-											0	0.00
CO			10	-											10	0.01
PM			6	-											6	0.00
VOC			3	-			474			496		4,549			5,522	2.76

Notes: (1) 1995 Janitorial supplies VOC revised to one third of 1997 value, since 1997 value is 3 times actual.

Table 5.10-4. Annual Dredging Emissions for Homeporting Actions at NAVSTA Everett.

Year/Construction Activity	Tons per Year VOC	CO	NOx	SOx	PM10
Year 1					
Dredging - Pier A and North Wharf (1)	0.45	3.68	17.08	1.52	0.47
Dredging - North Wharf Only (2)	0.14	1.19	5.51	0.49	0.15
Peak Activity	**0.45**	**3.68**	**17.08**	**1.52**	**0.47**

Notes: (1) Dredging emissions based on a total dredging volume of 155,000 cubic yards (cy).

(2) Dredging emissions for the north whart based on a dredging volume of 50,000 cy.

Table 5.10-5. Emission Source Data for Dredging Action at NAVSTA Everett.

Construction Activity/Equipment Type	Power Rating (Hp)	Load Factor	# Active	Hourly Hp-Hrs	Fuel Use (Gal/Hr)	Hours Per Day	Total Work Days	Total Fuel Use
Dredging(1)								
Dredge - Main Hoist	1,200	0.50	1	600	30.6	24	47	34,517
Dredge - Main Generator	900	0.50	1	450	23.0	24	47	25,888
Dredge - Deck Generator	240	0.60	1	144	7.3	5	47	1,726
Tug Boat	800	0.20	1	160	8.0	4	47	1,504
Ocean Disposal (2)								
Tug Boat	2,200	0.60	1	1,320	66.0	2.0	47	6,204

Notes: (1) Based on a daily dredging rate of 3,333 cubic yards (cy), or 4,000 cy with a 1.2 bulk factor. Total dredging volume would be 155,000 cy, or 186,000 cy with a 1.2 bulk factor.

(2) Based on a daily disposal rate of 4,000 cy (bulked), or two barge loads. Total disposal volume of 186,000 cy (bulked). Round trip distance to the ocean disposal site would be 4.5 miles and an average speed of 5 mph.

Table 5.10-6. Emission Factors for Dredging/Disposal Activities at NAVSTA Everett - CVN Homeporting.

Equipment Type	Fuel Type	Pounds/1000 Gallons (1) VOC	CO	NOx	SO2	PM	PM10	Source
Stationary Engines >600 Hp	D	11.1	111.0	424.8	39.5	13.6	13.3	(1)
Stationary Engines <600 Hp	D	43.3	129.3	600.2	39.5	42.2	41.4	(2)
Tug Boats	D	19.0	57.0	419.0	75.0	9.0	8.8	(3)

Notes: (1) AP-42, Table 3.4-1, Vol. I (EPA 1996).

(2) AP-42, Table 3.3-1, Vol. I (EPA 1996).

(3) Lloyd's Register of Shipping, London 1990, 1993, and 1995. From Acurex Env. Corp. 1996.

Table 5.10-7. Emissions for Dredging Action at NAVSTA Everett - CVN Homeporting.

Construction Activity/Equipment Type	Total Tons VOC	CO	NOx	SO2	PM	PM10
Dredging						
Dredge - Main Hoist (1)	0.2	1.9	7.3	0.7	0.2	0.2
Dredge - Main Generator (1)	0.1	1.4	7.8	0.5	0.2	0.2
Dredge - Deck Generator (1)	0.0	0.1	0.4	0.0	0.0	0.0
Tug Boat	0.0	0.0	0.3	0.1	0.0	0.0
Ocean Disposal						
Tug Boat Transport	0.1	0.2	1.3	0.2	0.0	0.0
Total Emissions - Tons	**0.4**	**3.7**	**17.1**	**1.5**	**0.5**	**0.5**

Table 5.10-8. Emissions from the Operation of + 4 AOEs and - 1 CVN at NS Everett.

4 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NSE + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	97,931			16,433	6,826					8			81,317	202,515	101.26	101.27
SOx	115,812			71	449					0				116,331	58.17	58.17
CO	8,596			4,086	1,471					1			514,853	529,007	264.50	264.51
PM	19,641	9		1,621	446					0			563	22,280	11.14	11.14
VOC	4,238		253	690	651	947	2,528	10,564		0	3,661		62,266	85,799	42.90	44.94
-1 CVN	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NSE + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx				(12,299)	(16,320)				-	(4)		(244)	(113,007)	(141,874)	(70.94)	(70.96)
SOx				(53)	(1,080)				-	0		(16)		(1,149)	(0.57)	(0.57)
CO				(3,059)	(3,540)				-	(1)		(53)	(716,928)	(723,580)	(361.79)	(361.80)
PM		(5)		(1,213)	(1,160)				-	0		(15)	(783)	(3,175)	(1.59)	(1.59)
VOC			(127)	(516)	(660)	(1,421)	(1,264)	(5,282)	-	0	(5,021)	(23)	(86,667)	(100,980)	(50.49)	(53.25)
Net Change	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NSE + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	97,931			4,134	(9,494)					4		(244)	(31,690)	60,641	30.32	30.31
SOx	115,812			18	(631)					0		(16)	-	115,182	57.59	57.59
CO	8,596			1,027	(2,069)					1		(53)	(202,075)	(194,573)	(97.29)	(97.29)
PM	19,641	4		408	(714)					0		(15)	(220)	19,105	9.55	9.55
VOC	4,238		126	174	(9)	(474)	1,264	5,282		0	(1,360)	(23)	(24,400)	(15,182)	(7.59)	(8.31)

Notes: (1) Data for most emission source categories obtained from Table 5.10-3, Volume 5 (EFA Northwest Environmental Technical Department 1995 and 1997).

(2) AOE power plant and onboard generator emissions based on data provided by NS Seattle.

(3) GSE data obtained from Chief Rickabaugh of GSE AIRPAC Everett.

Table 5.10-9. Emissions from the Operation of + 4 AOEs and - 1 CVN at FSC.

4 AOEs	*Emissions (Pounds per Year)*												
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Veh
NOx				25									
SOx				0									
CO				5									
PM				3									
VOC				2		395			362		3,317		
-1 CVN	*Emissions (Pounds per Year)*												
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Veh
NOx				(49)									
SOx				(0)									
CO				(10)									
PM				(6)									
VOC				(3)		(474)			(496)		(4,549)		
Net Change	*Emissions (Pounds per Year)*												
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Veh
NOx				(24)									
SOx				-									
CO				(5)									
PM				(3)									
VOC				(1)		(79)			(134)		(1,232)		

Table 5.10-10. Emissions from the Operation of + 2 AOEs at NS Everett.

2 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL NSE + FSC
	Vessel Power Plants	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOx	20,879			8,216	506					4			44,052	73,657	36.83	36.83
SOx	59,995			35	33					0				60,064	30.03	30.03
CO	3,317			2,043	109					1			278,908	284,378	142.19	142.19
PM	12,907	5		810	33					0			305	14,060	7.03	7.03
VOC	2,357		127	345	48	474	1,264	5,282		0	1,831		33,731	45,458	22.73	23.75

Table 5.10-11. Emissions from the Operation of + 2 AOEs at FSC.

2 AOEs	Emissions (Pounds per Year)													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers	Em Gens	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks		Vehicles	Lb/Yr	Ton/Yr
NOx				13										13	0.01
SOx				0										0	0.00
CO				3										3	0.00
PM				2										2	0.00
VOC				1		198			181		1,659			2,039	1.02

Table 5.10-12. ADT Composite Fleet Mix MOBILE 5 VOC Emission Factors

	5 MPH			25 MPH			55 MPH			Composite
Year	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
2000	8.15	7.94	0.05	2.32	2.23	0.55	1.40	1.40	0.40	2.21
2005	7.01	6.64	0.05	2.08	1.92	0.55	1.24	1.18	0.40	1.93
2007	6.85	6.40	0.05	2.05	1.85	0.55	1.21	1.14	0.40	1.87
2006 (1)	6.93	6.52	0.05	2.07	1.89	0.55	1.23	1.16	0.40	1.90

Note: Fleet mix based on average for Central Puget Sound Region (PSAPCA 1997).

(1) Average between 2005/2007.

Table 5.10-13. ADT Composite Fleet Mix MOBILE 5 CO Emission Factors

	5 MPH			25 MPH			55 MPH			Composite
Year	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
2000	80.94	56.34	0.05	23.02	15.76	0.55	12.34	8.69	0.40	18.30
2005	68.32	45.77	0.05	20.83	13.86	0.55	9.88	6.70	0.40	15.71
2007	66.49	44.56	0.05	20.49	13.66	0.55	9.46	6.41	0.40	15.34
2006 (1)	67.41	45.17	0.05	20.66	13.76	0.55	9.67	6.56	0.40	15.52

Note: Fleet mix based on Central Puget Sound Region (PSAPCA 1997).

(1) Average between 2005/2007.

Table 5.10-14. ADT Composite Fleet Mix MOBILE 5 NOx Emission Factors

	5 MPH			25 MPH			55 MPH			Composite
Year	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Grams/Mile
2000	3.50	3.13	0.05	2.70	2.38	0.55	3.53	3.11	0.40	2.89
2005	3.12	2.79	0.05	2.42	2.13	0.55	3.11	2.74	0.40	2.57
2007	2.99	2.66	0.05	2.32	2.05	0.55	2.98	2.63	0.40	2.47
2006 (1)	3.06	2.73	0.05	2.37	2.09	0.55	3.05	2.69	0.40	2.52

Note: Fleet mix based on Central Puget Sound Region (PSAPCA 1997).

(1) Average between 2005/2007.

Table 5.10-15. Vehicle Miles Travelled for Everett Alternative Components.

Project Scenario	*Week-day ADT*	*Week-end ADT(1)*	*Annual ADT*	*Miles/ Trip*	*Total Annual Miles*
+4 AOEs (2)					
Berthed	3,130	626	466,996	8.0	3,735,968
AOE Crew Dependents (3)	8,241	8,241	3,007,965	3.0	9,023,895
1 CVN (4)					
Berthed	4,194	839	688,655	8.0	5,509,238
Onbase Motorpool Mileage (5)	NA	NA	NA	NA	150,000
CVN Crew Dependents (3)	11,050	11,050	4,033,250	3.0	12,099,750
+2 AOEs (2)					
Berthed	1,695	339	252,894	8.0	2,023,152
AOE Crew Dependents (3)	4,465	4,465	1,629,725	3.0	4,889,175

(1) Week-end ADT assumed to be 20 percent of week-day estimates.

(2) Annual berthing of 186 days assumed for an AOE.

(3) Crew dependent trips would occur off-base. Percentage of crew that live offbase assumed to be the same for all vessel types.

(4) Represents a worst-case annual emissions scenario for a +1 CVN action at NAVSTA Everett. At berth time would be 213 days/year.

(5) (USN Public Works, NAVSTA Everett 1998).

Table 5.10-16. Annual Vehicle Emissions for Everett Alternatives.

Project Scenario/Year	*Pounds per Year*		
	VOC	*CO*	*NOx*
+4 AOEs/2000	62,266	514,853	81,317
1 CVN/2000	86,667	716,928	113,007
+2 AOEs/2000	33,731	278,908	44,052
+4 AOEs/2000 Tons/Yr	**31.13**	**257.43**	**40.66**
1 CVN/2000 Tons/Yr	**43.33**	**358.46**	**56.50**
+2 AOEs/2000 Tons/Yr	**16.87**	**139.45**	**22.03**

SECTION 5.15

NAVSTA EVERETT SUPPLEMENTAL HEALTH AND SAFETY INFORMATION

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NAVSTA EVERETT SUPPLEMENTAL HEALTH AND SAFETY INFORMATION

HAZARDOUS MATERIALS PROGRAM

NAVSTA Everett has implemented a program which provides an aggressive approach of eliminating, minimizing and controlling the procurement and use of hazardous materials. The program receives oversight from the Hazardous Material Control and Management Committee. This committee meets quarterly and its membership consists of the Executive Officer, Safety Officer, Environmental, FISC HAZMIN Center personnel, and workplace HM Control Coordinators.

A Hazardous Material Minimization Center (HMC) operates in the Supply/FISC building. The center was designed and created especially for this purpose. It has separate bays for segregation requirements, total designed containment in the event of a spill, blow-out walls in the flammable section to prevent extensive damage to the rest of the building should a serious mishap occur, automatic doors, and every other safety feature required for such a facility. The management of the HMC maintains and operates the Authorized Use List (AUL) and has the capability to track, by volume weight and bar coding, exactly where hazardous materials are used, and their volume. The operation of the HMC is based on procurement of new issues of materials, if required, and more importantly, a re-utilization concept so that hazardous materials can be shared by other AUL authorized users to completely use up the materials. This minimizes the amount of hazardous materials in the work place, thereby reducing significantly the potential for the injury, illness or fire, and hazardous waste disposal costs. This system allows the station to: (a) minimize hazardous materials that were being used, (b) minimize procurement of new hazardous materials due to the re-utilization concept, and (c) control these products to be able to substitute less hazardous materials whenever possible. The review and approval process is accomplished by computer links, using the new Hazardous Substance Management System (HSMS) software, and is extremely efficient in terms of time and manpower because the entire program is maintained in the computers with key terminals in selected locations. The result of this is that NAVSTA Everett shops only need retain a very minimum amount of hazardous materials in the shops, those that are to be used within a 7-day period. Their shop supplies are re-supplied by HMC personnel as requested and within established controls. The station has also implemented a labeling system that requires MSDS numbers of AUL entries, MSDS themselves and on each container for instant cross-referencing. Combined with training programs in Hazard Communication, workers are informed and aware of the hazards of hazardous materials and mishaps are prevented.