Appendix D Air Quality Emissions Calculations and Record of Non-Applicability

Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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APPENDIX D AIR QUALITY EMISSIONS CALCULATIONS AND RECORD OF NON-APPLICABILITY

This appendix discusses supplemental information, emission factor development, calculations, and assumptions used in the air quality analyses presented in Section 3.2 (Air Resources) of the Draft Mariana Islands Training and Testing (MITT) Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS). The Record of Non-applicability for the affected area is also included.

D.1 Air Quality Supplemental Information and Emission Calculations

Air pollution can damage the health of people, plants, animals, and water bodies as well as the exteriors of buildings, monuments, and statues. It also creates haze or smog that reduces visibility and interferes with aviation. A region's air quality is influenced by many factors, including the type and emission rate of pollutants, local meteorology, the size and topography of the air basin, and atmospheric chemistry. Wind speed and direction, the vertical temperature gradient of the atmosphere, and precipitation patterns affect the dispersal, dilution, and removal of air pollutant emissions from the atmosphere. Most air pollutants originate from human-made sources, including mobile sources (e.g., gasoline- or diesel-fueled vehicles) and stationary sources (e.g., power plants, refineries, etc.), as well as indoor sources (e.g., some building materials and cleaning solvents). Air pollutants are also released from natural sources such as volcanic eruptions and wildfires. Ambient air quality is reported as the atmospheric concentrations of specific air pollutants at a particular time and location. The units of measure are expressed as a mass per unit volume (e.g., micrograms per cubic meter of air) or as a volume fraction (e.g., parts per million [ppm] by volume).

D.1.1 Emission Sources

Criteria air pollutants and Hazardous Air Pollutants (HAP are generated by the combustion of fuel by surface vessels and by fixed-wing and rotary-wing aircraft. They also are generated by the combustion of explosives and propellants in various types of munitions. Propellants used to fire small-, medium-, and large-caliber projectiles generate pollutants when detonated. Nonexplosive practice munitions may contain spotting charges and propellants that generate air pollutants when they function. Powered targets require fuel, generating air pollutants during their operation, and towed targets generate air pollutants secondarily because another aircraft or vessel is required to provide power. Stationary targets may generate air pollutants if all or portions of the item burn in a high-order detonation. Chaff cartridges used by ships and aircraft are launched by an explosive charge that generates small quantities of air pollutants. Chaff itself may also be a particles with aerodynamic diameters less than or equal to a nominal 10 micrometers (PM_{10})/ particles with aerodynamic diameters less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$) pollutant, depending on its size. Countermeasure flares, decelerators/parachute flares, and smoke floats are designed to burn for a prescribed period, emitting pollutants in the process. Emissions from activities related to modernization and sustainment of ranges are also estimated and the impacts analyzed.

D.1.2 Emissions Estimates

The emissions calculations performed for each alternative conservatively assume that each training and testing activity is separately conducted. In practice, a testing activity may be conducted during a training flight. It is also probable that two or more training activities may be conducted during one flight or one

vessel movement (e.g., chaff or flare exercises may occur during electronic warfare activities; or air-to-surface gunnery and air-to-surface bombing activities may occur during a single flight operation, or ship may conduct large-, medium-, and small-caliber surface-to-surface gunnery exercises during one vessel movement). Conservative assumptions may produce elevated emissions calculations but account for the possibility, however remote, that each training and testing activity is separately conducted.

The estimated change in emissions includes transit emissions from shore location to range location for ship and aircraft, startup/idle/shutdown emissions to prepare for shore connect and disconnect, and emissions due to aircraft startup/idle, and idle/shutdown activities.

D.1.2.1 Aircraft Activities

Fleet training and Naval Air Systems Command testing use various aircraft. Aircraft operations of concern, for calculating criteria pollutant and HAP, are those that occur from ground level up to 3,000 feet (ft.) above ground level (AGL). The 3,000 ft. AGL altitude was assumed to be the ceiling of the mixing zone (known as the atmospheric mixing height) above which any pollutant generated would not contribute to increased pollutant concentrations at ground level. Pollutants emitted by aircraft above 3,000 ft. AGL are excluded from the analysis of compliance with National Ambient Air Quality Standards. The pollutant emission rate is a function of the aircraft engine's fuel flow rate and efficiency. Emissions for one complete training activity for a particular aircraft are calculated by knowing the specific engine pollutant emission factors for each mode of operation.

Emission factors for most military engines were obtained from the Navy's Aircraft Environmental Support Office memoranda. For those aircraft for which engine data were unavailable from Aircraft Environmental Support Office, emission factors from Air Emissions Guide for Air Force Mobile Source, June 2024 (U.S. Department of the Air Force, 2024), were used. Emission rates, in pounds per hour, were developed based on the emission indices in pounds of pollutant per 1,000 gallons of fuel, number of engines per aircraft, and the fuel flow rate per engine at a given power setting. Using these data, as well as the number of sorties, pollutant emissions for each aircraft were calculated by applying the equation below.

$$Emissions = N \times FF \times EF \times ENG \times CF$$

Where:

Emissions = annual aircraft emissions (pounds [lb.]/yr.)
N = Hours of operation of aircraft operations per year for each type of aircraft per activity (hr./yr.)
EF = pollutant emission rate by engine type and power setting (lb/hr)
CF = conversion factor (0.001)

"Taxi/Idle out and Taxi/Idle in" emission factors were used to estimate aircraft emissions during preparation for shore connect and disconnect. "Approach" or "Cruise" modes emission factors were used to estimate the transit emissions from shore location to range location. It was assumed that fixed-wing aircraft would fly above 3,000 ft. AGL during transit to range locations, and rotary aircraft would fly within 3,000 ft. AGL during transit.

HAP emissions were estimated based on June 2024 Air Emissions Guide for Air Force Mobile Sources, Table 2-10 (Volatile Organic Compound and HAP Emission Factors for Select Engines) (Air Force Civil Engineer Center, 2023). HAP emissions from activities in many range areas occur well offshore and far

from any publicly accessible areas. HAP emissions from activities that occur within 12 nautical miles (NM) may impact the publicly accessible areas on shore.

D.1.2.2 Military Vessel Activities

Military vessel traffic in the Study Area includes military ships and vessels providing security for military training and testing activities during transit from the pier to the range and back. Fleet training activities use a variety of marine vessels, including cruisers, destroyers, carriers, submarines, amphibious vessels, and small boats. Testing activities use a variety of marine vessels, including various testing support vessels, work boats, torpedo recovery vessels, unmanned surface vehicles, and small boats. These vessels use diverse propulsion methods, including marine outboard engines, diesel engines, and gas turbines.

Emissions from military vessels and small boats are estimated based on the type of vessel, the anticipated activity, and the average operating hours in each operational area, both within state waters and beyond state waters. The types of military ships and boats as well as the numbers of activities for Alternatives 1 and 2 are derived from range records and Navy subject matter experts regarding ship participant data. Estimates of future military vessel activities are based on anticipated evolutionary changes in the military's force structure and mission assignments.

Emission factors for small surface craft involved in amphibious training and testing activities were obtained from the Navy and Military Sealift Command Marine Engine Fuel Consumption & Emission Calculator database Version October 2024. Emissions for surface craft using outboard engines were calculated using Navy and Military Sealift Command emission factors which are provided in terms of Vessel Emission Total per hour and multiplied by the hours of operation.

$$Emissions = HR/YR \times EF$$

Where:

Emissions = surface craft emissions (*pounds [lb.]/yr)*

HR/YR = hours per year per vessel per activity (hr/yr)

EF = emission factor for specific vessel (lb./hr)

Large vessel emissions were calculated in a similar fashion using emission factors from the Naval Sea Systems Command Navy and Military Sealift Command Marine Engine Fuel Consumption and Emission Calculator for the propulsion system and the supplemental ship service generator(s).

"Not Underway" emission factors were used to estimate ship emissions during preparation for shore connect and disconnect. "Restricted Waters" emission factors were used to estimate the transit emissions from shore location to range location.

To obtain the total criteria pollutant emissions for the Proposed Action, emissions were calculated for each training or testing activity, type of surface vessel, and criteria pollutant. These individual estimates of emissions, in units of tons per year, were then summed by criteria pollutant to obtain the aggregate emissions for surface vessel emissions activities.

HAP emissions were estimated based on the speciation factors in the U.S. Environmental Protection Agency (USEPA) Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions (U.S. Environmental Protection Agency, 2022).

D.1.2.3 Munitions

Naval gunfire, missiles, bombs, and other types of munitions used in training and testing activities emit air pollutants. To estimate the amounts of air pollutants emitted by munitions, the numbers and types of munitions used during training or testing activities are first totaled. Then generally accepted emissions factors, such as those from USEPA AP-42, *Compilation of Air Pollutant Emission Factors* Section 15, for criteria air pollutants and HAPs are applied to the total amounts. These factors are multiplied by the net weight of the explosive and the number of items that were used per year. This calculation provides estimates of annual emissions.

$$Emissions = EXP/YR \times EF \times Net\ Wt$$

Where:

Emissions = annual ordnance emissions
EXP/YR = number of explosives, propellants, and pyrotechnics items used per year
EF = air pollutant emissions factor per item
Net Wt = net weight of explosive, propellant, or pyrotechnics per ordnance item

D.1.3 Modernization and Sustainment of Ranges

The Proposed Action also includes modernization and sustainment of ranges activities that involve Navy and contractor vessels. The vessel emissions are estimated based on the methodology described in Section D.1.2.2.

D.2 Greenhouse Gas Emissions

The Proposed Action is anticipated to release greenhouse gases into the atmosphere. These emissions are quantified using the aircraft and vessel emission calculation methodologies described in Section D.1.2. Emissions of greenhouse gases from aircraft and vessels participating in training and testing activities, as well as targets and munitions expended, are applicable regardless of altitude.

D.3 Meteorological Conditions and Topography of the Study Area

Pollution dispersion in the air is influenced by meteorological conditions, such as temperature, wind speed and wind direction, and atmospheric stability. Warmer air traps cooler air near the surface and can slow dispersion, whereas unstable atmospheric conditions can facilitate dispersion. Topography is another factor that influences pollutant dispersion. Urban areas with tall buildings can disrupt wind patterns and trap pollutants. Mountains and valleys can channel air and promote dispersion or trap pollutants during inversions. Wind direction determines the dispersion path pollutants take. Higher wind speeds disperse pollutants over a larger area; stagnant conditions or light winds allow pollutant concentrations to build up due to a more coherent plume. A wind rose for a particular location provides a view of how wind speed and direction are typically distributed. The wind rose represents the directions around a compass, and the length of the petal or spoke indicates wind direction and frequency toward the center point. Individual segments of the spoke represent the frequency of winds for defined wind speed categories, with the slowest winds closest to and the fastest winds furthest from the center of the diagram.

Figure D-1 depicts wind rose data from January 2020 to December 2024, collected by the weather station located at Guam International Airport. Figure D-2 and Figure D-3 depict wind roses for Saipan and Tinian, respectively.

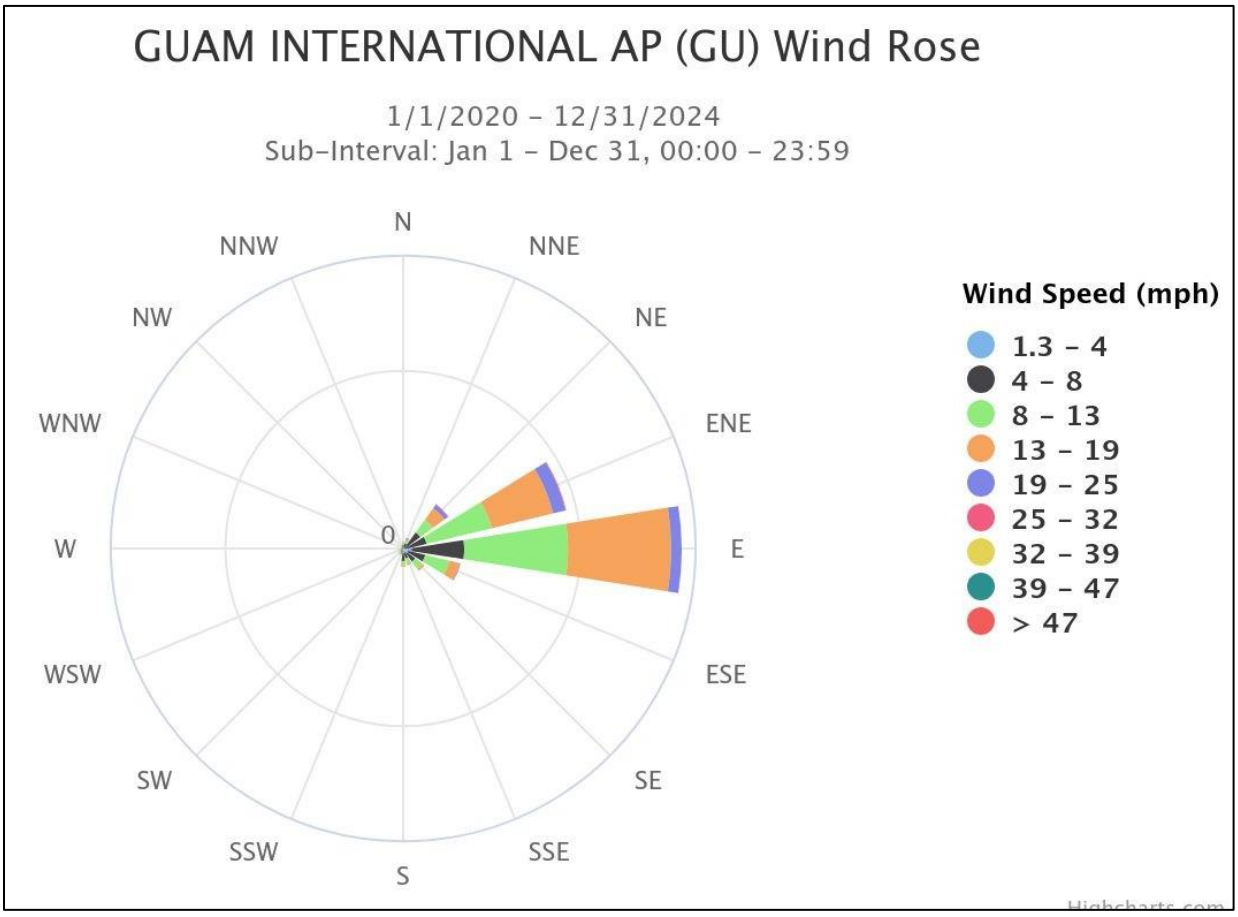

Figure D-1: Annual Wind Speed and Direction at Guam International Airport

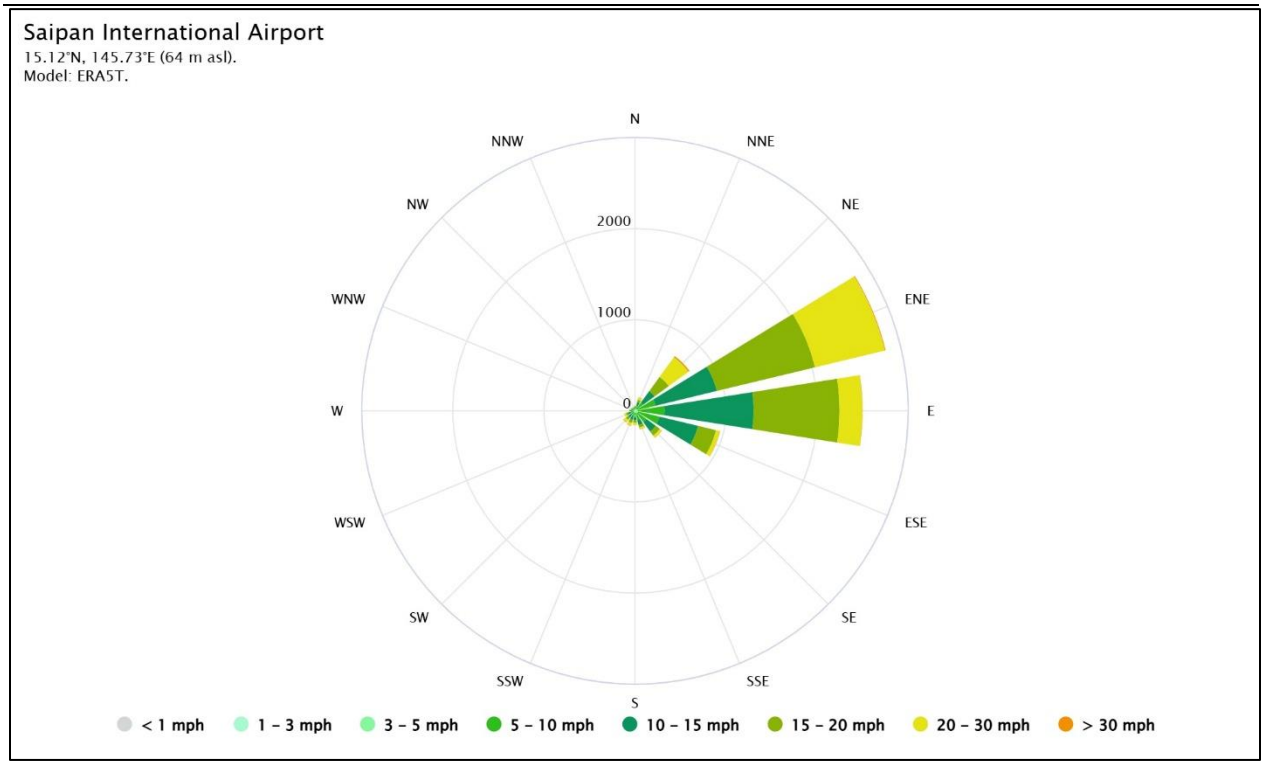

Figure D-2: Wind Speed and Direction Snapshot at Saipan International Airport

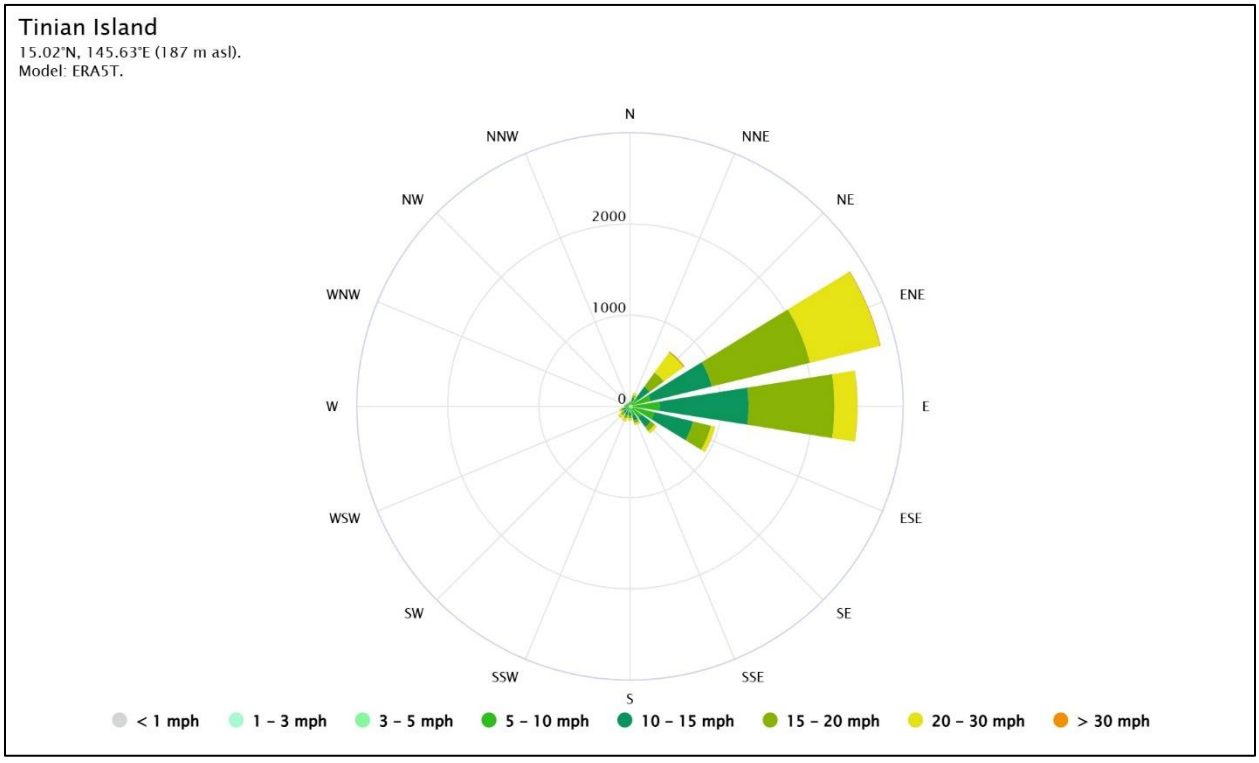

Figure D-3: Wind Speed and Direction Snapshot at Tinian Island

D.4 Existing Air Quality

The USEPA designated the Northern Mariana Islands to be in attainment or unclassified for all criteria pollutants (40 Code of Federal Regulations 81.354). Because the Commonwealth of the Northern Mariana Islands is in attainment of the National Ambient Air Quality Standards (NAAQS), a state implementation plan is not required. As shown in Figure D-4, Guam is in attainment with all NAAQS, except for areas centered on Piti and Tanguisson power plants that are in nonattainment for the 1971 Sulfur Dioxide (SO_2) NAAQS ((U.S. Environmental Protection Agency, 2025), and the Piti-Cabras area is in nonattainment for the 2010 SO_2 NAAQS, effective April 9, 2018 (U.S. Environmental Protection Agency, 2025).

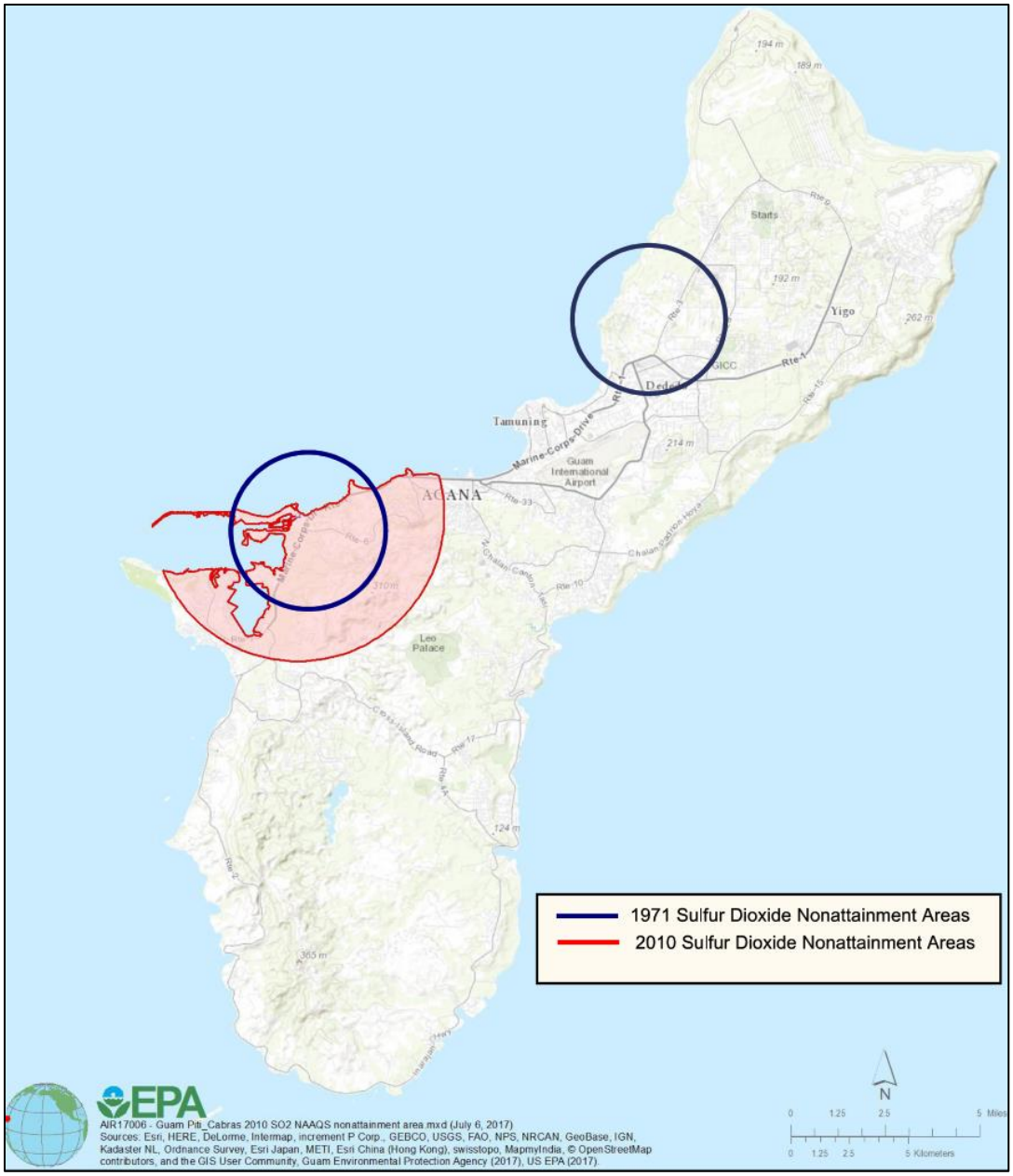

Figure D-4: Guam Sulfur Dioxide Nonattainment Areas

D.5 Sensitive Receptors

The Study Area includes pierside locations in Apra Harbor, Guam, and Tinian and Saipan nearshore locations where public exposure to the increase in emissions could occur. Figure D-5 presents the sensitive receptors near Apra Harbor, which include public parks, William C. McCool Elementary and Middle School, Navy Gateway Inns and Suites, and Naval Base Guam Medical Branch Clinic on Guam. Figure D-6 and Figure D-7 present the sensitive receptors near the proposed activity areas on Saipan and Tinian.

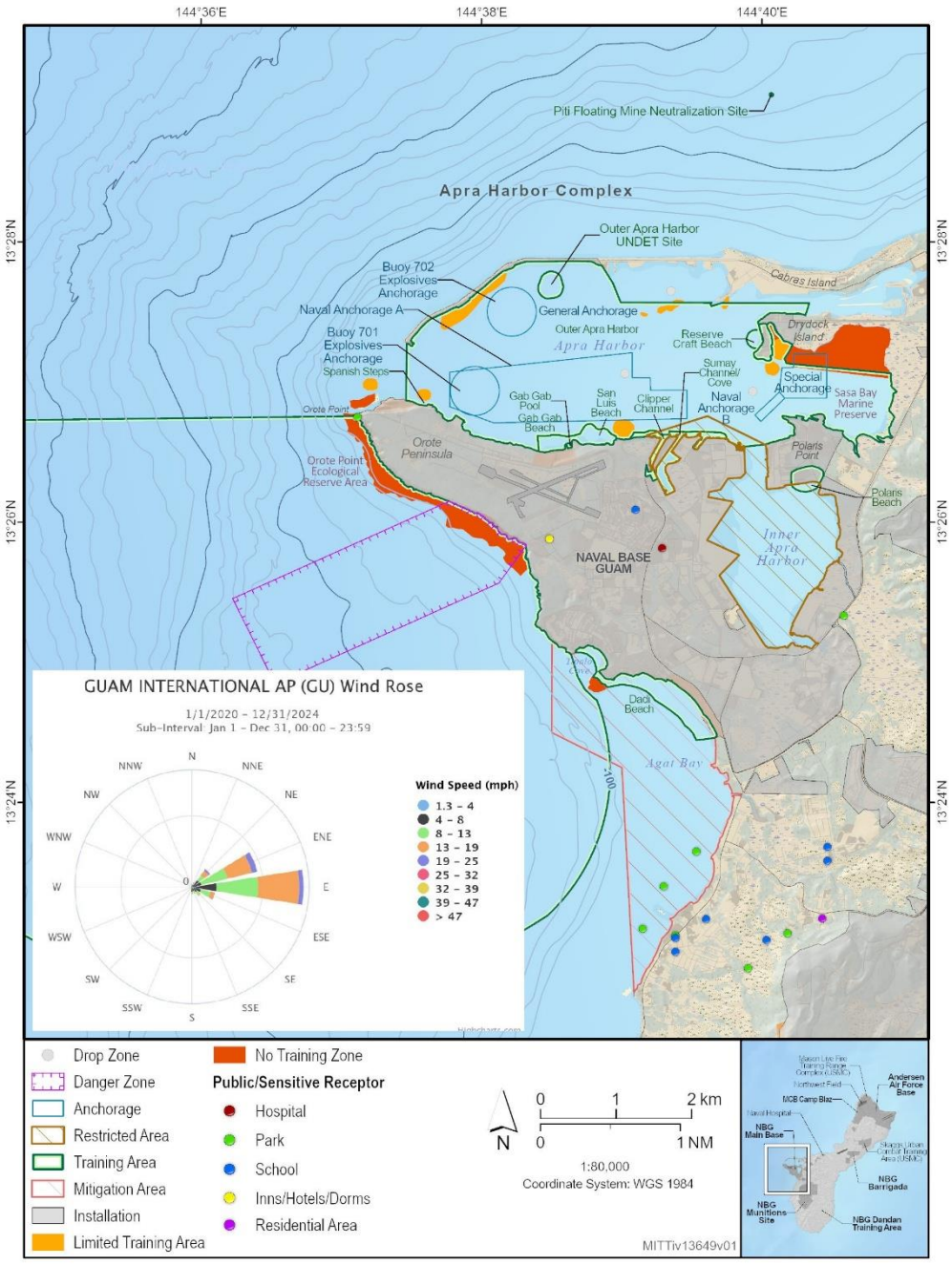

Figure D-5: Sensitive Receptors Near Pierside Locations in Apra Harbor, Guam

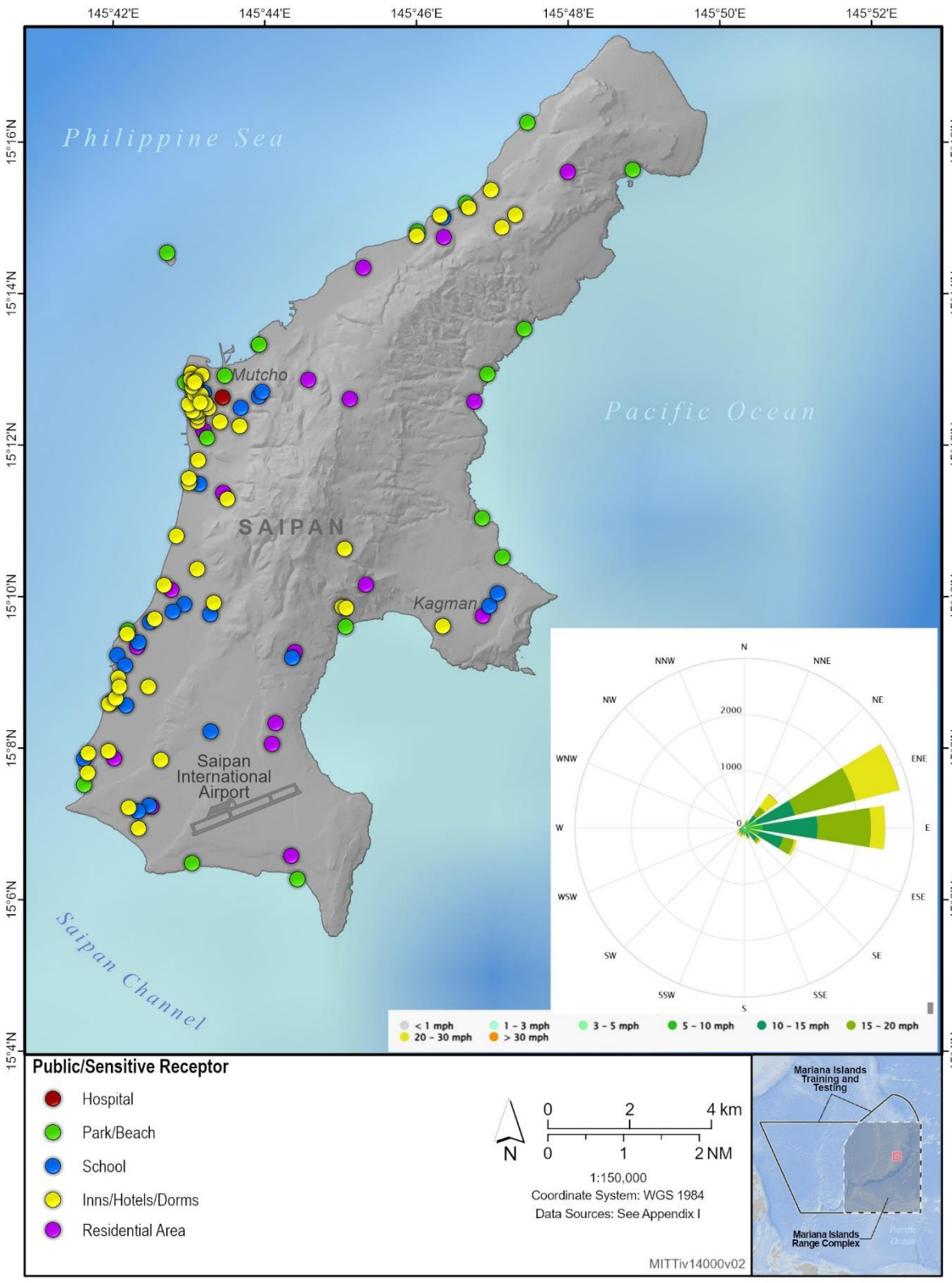

Figure D-6: Sensitive Receptors Near Proposed Activity Areas, Saipan Island

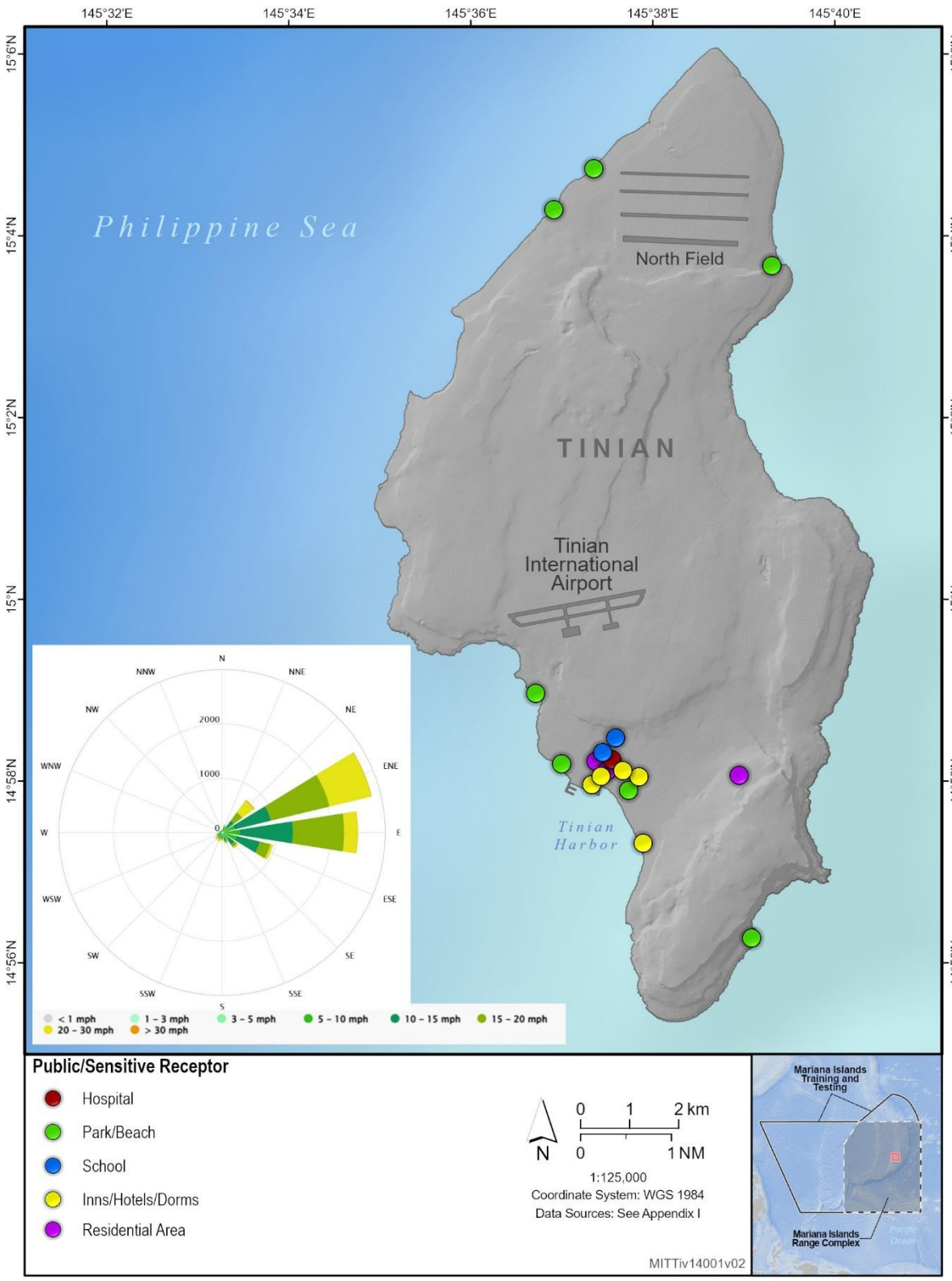

Figure D-7: Sensitive Receptors Near Proposed Activity Areas, Tinian Island

D.6 Emissions Estimates Spreadsheets

Tables D-1 through D-7 provide proposed changes to training and testing activities, emissions factors, and example emissions summaries for aircraft, vessels, and munitions for Alternatives 1 and 2.

Table D-1: Proposed Changes to Training Activities

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect, startup and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
Major Training Exercises – Large Integrated Anti-Submarine Warfare Training	Joint Multi-Strike Group Exercise	2.25	1.75	2.25	80	0%	0%	100%	0.65	0.65	0.25	8	0%	0%	100%	MIRC	1	1	1	0	0
Major Training Exercises – Large Integrated Anti-Submarine Warfare Training	Joint Expeditionary Exercise	2.25	1.75	2.25	80	0%	0%	100%	0.65	0.65	0.25	8	0%	0%	100%	MIRC	1	0	0	-1	-1
Small Integrated Anti-Submarine Warfare Training	Surface Warfare Advanced Tactical Training	2.25	1.75	2.25	40	0%	50%	50%	0.65	0.65	0.5	8	0%	50%	50%	MIRC	3	1	1	-2	-2
Small Coordinated Anti-Submarine Warfare Training	Independent Deployer Certification Exercise/Tailored Surface Warfare Training	2.25	1.75	2.25	24	0%	0%	100%	0.65	0.65	0.5	36	0%	0%	100%	MIRC	3	5	5	2	2
Small Integrated Anti-Submarine Warfare Training	Small Integrated Anti-Submarine Warfare – NUWTAC/Multi-Sail	2.25	1.75	2.25	40	0%	0%	100%	0.65	0.65	0.5	8	0%	100%	0%	MIRC	3	7	7	4	4
Medium Coordinated Anti-Submarine Warfare Training	Medium Coordinated Anti-Submarine Warfare	2.25	1.75	2.25	80	0%	0%	100%	0.65	0.65	0.5	24	0%	0%	100%	MIRC	3	5	5	2	2
Air Warfare	Air Combat Maneuvers Guam					0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	4800	4800	4800	0	0
Air Warfare	Air Combat Maneuvers CNMI					0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	1800	480	480	-1320	-1320
Air Warfare	Air Combat Maneuvers Carrier based	2.25	1.75	2.25	1	0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	2300	2480	2480	180	180
Air Warfare	Air Defense Exercise Carrier Based					0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	88	1110	1110	1022	1022
Air Warfare	Air Defense Exercise GUAM					0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	12	12	12	0	0
Air Warfare	Gunnery Exercise Air-to-Air Medium-Caliber Carrier Based					0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	18	24	24	6	6

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect, startup, and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
Air Warfare	Gunnery Exercise Air-to-Air Medium-Caliber Guam					0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	18	24	24	6	6
Air Warfare	Gunnery Exercise Surface-to-Air Large-Caliber				2	0%	0%	100%					0%	0%	100%	MIRC	9	14	14	5	5
Air Warfare	Gunnery Exercise Surface-to-Air Medium-Caliber				2	0%	0%	100%					0%	0%	100%	MIRC	19	23	23	4	4
Air Warfare	Air Defense Exercise Carrier Based				1	0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	12	12	12	0	0
Air Warfare	Air Defense Exercise GUAM					0%	0%	100%	0.65	0.65	0.5	1	0%	0%	100%	MIRC	6	6	6	0	0
Air Warfare	Missile Exercise Surface-to-Air	2.25	1.75	2.25	2	0%	0%	100%								MIRC	27	8	8	-19	-19
Amphibious Warfare	Amphibious Assault	2.25	1.75	2.25	8	100.0%	0.0%	0.0%	0.65	0.65	0.5	18	100%	0%	0%	CNMI	4	20	20	16	16
Amphibious Warfare	Amphibious Assault	2.25	1.75	2.25	8	100.0%	0.0%	0.0%	0.65	0.65	0.5	18	100%	0%	0%	Guam	2	4	4	2	2
Amphibious Warfare	Amphibious Raid	2.25	1.75	2.25	6	100.0%	0.0%	0.0%	0.65	0.65	0.5	12	100%	0%	0%	Guam	2	4	5	2	3
Amphibious Warfare	Amphibious Raid	2.25	1.75	2.25	6	100.0%	0.0%	0.0%	0.65	0.65	0.5	12	100%	0%	0%	Tinian	1	4	5	3	4
Amphibious Warfare	Amphibious Raid	2.25	1.75	2.25	6	100.0%	0.0%	0.0%	0.65	0.65	0.5	12	100%	0%	0%	Rota	1	4	5	3	4
Amphibious Warfare	Amphibious Vehicle Maneuvers/Rehearsals	2.25	1.75	2.25	4	100.0%	0.0%	0.0%								Apra Harbor	0	16	16	16	16
Amphibious Warfare	Amphibious Vehicle Maneuvers/Rehearsals	2.25	1	1	4	100.0%	0.0%	0.0%								MIRC	12	12	12	0	0
Amphibious Warfare	Unmanned Aerial Vehicle – Intelligence, Surveillance, and Reconnaissance								0.65	0.65	0.5	4	50%	25%	25%	MIRC	100	432	432	332	332
Amphibious Warfare	Naval Surface Fire Support Exercise – Land-Based Target				8	0%	50%	50%								FDM	15	5	5	-10	-10
Amphibious Warfare	Non-Combat Amphibious Operation	2.25	1.75	2.25	80	100.0%	0.0%	0.0%	0.65	0.65	0.5	20	100.0%	0.0%	0.0%	Guam	4	7	7	3	3
Amphibious Warfare	Non-Combat Amphibious Operation	2.25	1.75	2.25	80	100.0%	0.0%	0.0%	0.65	0.65	0.5	20	100.0%	0.0%	0.0%	Tinian	5	6	6	1	1
Amphibious Warfare	Non-Combat Amphibious Operation	2.25	1.75	2.25	80	100.0%	0.0%	0.0%	0.65	0.65	0.5	20	100.0%	0.0%	0.0%	Rota	1	2	2	1	1

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect, startup, and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
Amphibious Warfare	Marine Air Ground Task Force Exercise (Amphibious) – Battalion																			0	0
Amphibious Warfare	Special Purpose Marine Air Ground Task Force Exercise																			0	0
Anti-Submarine Warfare	Anti-Submarine Warfare Torpedo Exercise – Helicopter				4	0%	0.0%	100%	0.65	0.65	0.5	4	0%	0.0%	100%	MIRC	6	1	1	-5	-5
Anti-Submarine Warfare	Anti-Submarine Warfare Torpedo Exercise – Maritime Patrol Aircraft								0.65	0.65	0.5	6	0%	0.0%	100%	MIRC	6	1	2	-5	-4
Anti-Submarine Warfare	Anti-Submarine Warfare Torpedo Exercise – Ship				2	0%	0%	100%								MIRC	6	8	8	2	2
Anti-Submarine Warfare	Anti-Submarine Warfare Torpedo Exercise – Submarine				2	0%	0%	100%								MIRC	4	2	2	-2	-2
Anti-Submarine Warfare	Anti-Submarine Warfare Tracking Exercise – Helicopter	2.25	1	1	2	0%	24%	76%	0.65	0.65	0.5	4	0%	0%	100%	MIRC	7	10	10	3	3
Anti-Submarine Warfare	Anti-Submarine Warfare Tracking Exercise – Helicopter	2.25	1	1	2	0%	24%	76%	0.65	0.65	0.5	4	0%	0%	100%	Transit Corridor	5	6	6	1	1
Anti-Submarine Warfare	Anti-Submarine Warfare Tracking Exercise – Maritime Patrol Aircraft								0.65	0.65	0.5	6	0%	0%	100%	MIRC	36	60	60	24	24
Anti-Submarine Warfare	Anti-Submarine Warfare Tracking Exercise – Ship	2.25	2.75	2.25	2	0%	0%	100%								MIRC	91	90	90	-1	-1
Anti-Submarine Warfare	Anti-Submarine Warfare Tracking Exercise – Submarine	2.25	2.75	2.25	2	0%	0%	100%								MIRC	10	10	10	0	0

		VESSELS							AIRCRAFT										Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)									
Category	Activity Name	Time to prepare for shore disconnect, startup and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
Anti-Submarine Warfare	Anti-Submarine Warfare Tracking Exercise – Submarine				2	0%	0%	100%								Transit Corridor	2	4	4	2	2
Electronic Warfare	Counter Targeting Chaff Exercise – Aircraft											2	0%	0%	100%	MIRC	2200	1730	1730	-470	-470
Electronic Warfare	Counter Targeting Chaff Exercise – Ship				4	0%	0%	100%								MIRC	60	10	10	-50	-50
Electronic Warfare	Counter Targeting Flare Exercise											2	0%	0%	100%	MIRC	2200	1730	1730	-470	-470
Electronic Warfare	Electronic Warfare Operations	2.25	1.75	2.25	4	0%	0%	100%				2	0%	0%	100%	MIRC	522	1160	1160	638	638
Expeditionary Warfare	Dive and Salvage Operations	2.25	1.75	2.25	1.0	100%	0%	0%								MIRC	0	125	125	125	125
Expeditionary Warfare	Dive and Salvage Operations	2.25	1.75	2.25	1.0	100%	0%	0%								Apra Harbor	0	125	125	125	125
Expeditionary Warfare	Underwater Construction Team Training	2.25	1.75	2.25	12	100%	0%	0%								MIRC	0	25	25	25	25
Expeditionary Warfare	Underwater Construction Team Training	2.25	1.75	2.25	12	100%	0%	0%								Apra Harbor	0	25	25	25	25
Expeditionary Warfare	Personnel Insertion/ Extraction – Air				8	50%	40%	10%	0.65	0.65	0.5	8	50%	40%	10%	Guam	20	33	33	13	13
Expeditionary Warfare	Personnel Insertion/ Extraction – Air				8	50%	40%	10%	0.65	0.65	0.5	8	50%	40%	10%	Tinian	20	33	33	13	13
Expeditionary Warfare	Personnel Insertion/ Extraction – Air				8	50%	40%	10%	0.65	0.65	0.5	8	50%	40%	10%	Rota	20	33	33	13	13
Expeditionary Warfare	Personnel Insertion/Extraction – Surface and Subsurface	2.25	1.75	2.25	2	0%	50%	50%								Guam	46	71	71	25	25
Expeditionary Warfare	Personnel Insertion/Extraction – Surface and Subsurface	2.25	1.75	2.25	2	0%	50%	50%								Tinian	46	71	71	25	25
Expeditionary Warfare	Personnel Insertion/Extraction –	2.25	1.75	2.25	2	0%	50%	50%								Rota	46	71	71	25	25

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect, startup, and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
	Surface and Subsurface																				
Expeditionary Warfare	Personnel Insertion/ Extraction – Swimmer/Diver	2.25	1.75	2.25	2	50%	50%	0%								Guam	36	18	13	-18	-23
Expeditionary Warfare	Personnel Insertion/ Extraction – Swimmer/Diver	2.25	1.75	2.25	2	50%	50%	0%								Tinian	36	18	13	-18	-23
Expeditionary Warfare	Personnel Insertion/ Extraction – Swimmer/Diver	2.25	1.75	2.25	2	50%	50%	0%								Rota	36	18	13	-18	-23
Expeditionary Warfare	Port Damage Repair (No Dredging/No Pile Driving)	2.25	1.75	2.25	8	100%	0%	0%								MIRC	0	25	25	25	25
Expeditionary Warfare	Port Damage Repair (No Dredging/No Pile Driving)	2.25	1.75	2.25	8	100%	0%	0%								Apra Harbor	0	25	25	25	25
Mine Warfare	Mine Countermeasure – Mine Detection								0.65	0.65	0.5	2	100%	0%	0%	MIRC	4	8	8	4	4
Mine Warfare	Airborne Mine Laying								0.65	0.65	0.5	1	0%	50%	50%	MIRC	4	4	4	0	0
Mine Warfare	Limpet Mine Neutralization System				4	100%	0%	0%								Apra Harbor	30	30	30	0	0
Mine Warfare	Limpet Mine Neutralization System	2	1	1	4	100%	0%	0%								Agat Bay	30	30	30	0	0
Mine Warfare	Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercise	2.25	1.75	2.25	24	100%	0%	0%	0.65	0.65	0.5	12	100%	0%	0%	Apra Harbor	1	1	1	0	0
Mine Warfare	Mine Countermeasures – Towed Mine Neutralization	2.25	1.75	2.25	4	100%	0%	0%	0.65	0.65	0.5	2	0%	50%	50%	CNMI	4	8	8	4	4
Mine Warfare	Mine Neutralization Explosive Ordnance Disposal	2.25	1.75	2.25	2	100%	0%	0%	0.65	0.65	0.5	2	100%	0%	0%	Guam	20	20	20	0	0
Mine Warfare	Surface Ship Object Detection				1	100%	0%	0%								CNMI	3	15	15	12	12

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect, startup, and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
Mine Warfare	Surface Ship Object Detection				1	100%	0%	0%								Apra Harbor	3	15	15	12	12
Mine Warfare	Underwater Demolition Qualification and Certification	2.25	1.75	2.25	2	100%	0%	0%	0.65	0.65	0.5	2	100%	0%	0%	Guam	45	45	45	0	0
Mine Warfare	Underwater Mine Countermeasure Raise, Tow, Beach, and Exploitation	2.25	1.75	2.25	2	100%	0%	0%								Apra Harbor	4	24	24	20	20
Surface Warfare	Bombing Exercise Air-to-Surface								0.65	0.65	0.5	1.5	0%	0%	100%	MIRC	37	39	39	2	2
Surface Warfare	Fast Attack Craft and Fast Inshore Attack Craft	2.25	1.75	2.25	4	0%	50%	50%	0.65	0.65	0.5	4	0%	50%	50%	MIRC	27	33	33	6	6
Surface Warfare	Gunnery Exercise Air-to-Surface Medium Caliber								0.65	0.65	0.5	2	0%	50%	50%	MIRC	120	130	130	10	10
Surface Warfare	Gunnery Exercise Air-to-Surface Small Caliber								0.65	0.65	0.5	2	0%	50%	50%	MIRC	321	418	418	97	97
Surface Warfare	Gunnery Exercise Surface-to-Surface Boat Medium Caliber	2.25	1.75	2.25	1	0%	75%	25%								MIRC	20	24	24	4	4
Surface Warfare	Gunnery Exercise Surface-to-Surface Boat Small Caliber	2.25	1.75	2.25	3	0%	75%	25%								MIRC	43	44	44	1	1
Surface Warfare	Gunnery Exercise Surface-to-Surface Ship Large Caliber				3	0%	0%	100%								MIRC	253	255	255	2	2
Surface Warfare	Gunnery Exercise Surface-to-Surface Ship Large Caliber				3	0%	0%	100%								Transit Corridor	2	2	2	0	0
Surface Warfare	Gunnery Exercise Surface-to-Surface Ship Medium Caliber				3	0%	0%	100%								MIRC	117	150	150	33	33
Surface Warfare	Gunnery Exercise Surface-to-Surface Ship Small Caliber				3	0%	50%	50%								MIRC	117	230	230	113	113

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect, startup, and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
Surface Warfare	Laser Targeting – Aircraft								0.65	0.65	0.5	2	0%	0%	100%	MIRC	600	310	310	-290	-290
Surface Warfare	Laser Targeting – Ship				2	0%	25%	75%								MIRC	600	5	5	-595	-595
Surface Warfare	Maritime Security Operations	2.25	1.75	2.25	8	100%	0%	0%	0.65	0.65	0.5	2	100%	0%	0%	Apra Harbor	20	70	70	50	50
Surface Warfare	Maritime Security Operations	2.25	1.75	2.25	8	25%	25%	50%	0.65	0.65	0.5	2	0%	50%	50%	MIRC	20	70	70	50	50
Surface Warfare	Missile Exercise Air-to-Surface								0.65	0.65	0.5	2	0%	0%	100%	MIRC	10	50	50	40	40
Surface Warfare	Missile Exercise Air-to-Surface Rocket								0.65	0.65	0.5	2	0%	0%	100%	MIRC	111	47	47	-64	-64
Surface Warfare	Missile Exercise Surface-to-Surface	2.25	1.75	2.25	3	0%	0%	100%	0.65	0.65	0.5	3	0%	0%	100%	MIRC	28	9	9	-19	-19
Surface Warfare	Sinking Exercise (SINKEX)	2.25	1.75	2.25	16	0%	0%	100%	0.65	0.65	0.5	16	0%	0%	100%	MIRC	1	2	2	1	1
Surface Warfare	Torpedo Exercise (Submarine-to-Surface)				8	0%	0%	100%								MIRC	0	5	5	5	5
Surface Warfare	Small Boat Attack	2.25	1.75	2.25	8	0%	50%	50%								MIRC	27	8	8	-19	-19
Other Training Exercises	Direct Action (Tactical Air Control Party)								0.65	0.65	0.5	8	100%	0%	0%	FDM	18	18	18	0	0
Other Training Exercises	Submarine Navigation				2	100%	0%	0%								Apra Harbor	4	25	25	21	21
Other Training Exercises	Submarine Navigation				2	50%	50%	0%								MIRC	4	25	25	21	21
Other Training Exercises	Precision Anchoring				8	100%	0%	0%								Apra Harbor	9	10	10	1	1
Other Training Exercises	Precision Anchoring				8	100%	0%	0%								MIRC Anchorages	9	10	10	1	1
Other Training Exercises	Search and Rescue	2.25	1.75	2.25	2	40%	40%	20%	0.65	0.65	0.5	2	40%	40%	20%	MIRC	45	52	52	7	7
Other Training Exercises	Submarine Sonar Maintenance and Systems Checks				8	100%	0%	0%								Apra Harbor	42	45	45	3	3
Other Training Exercises	Submarine Sonar Maintenance and Systems Checks	2.25	1.75	2.25	4	0%	50%	50%								MIRC	42	45	45	3	3
Other Training Exercises	Submarine Sonar Maintenance and Systems Checks				4	0%	0%	100%								Transit Corridor	2	2	2	0	0

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect, startup, and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
Other Training Exercises	Surface Ship Sonar Maintenance and Systems Checks				8	100%	0%	0%								Apra Harbor	20	24	24	4	4
Other Training Exercises	Surface Ship Sonar Maintenance and Systems Checks				4	0%	50%	50%								MIRC	20	24	24	4	4
Other Training Exercises	Surface Ship Sonar Maintenance and Systems Checks				4	0%	0%	100%								Transit Corridor	4	4	4	0	0
Strike Warfare	Bombing Exercise Air-to-Ground								0.65	0.65	0.5	2	0%	0%	100%	FDM	1500	1200	1200	-300	-300
Strike Warfare	Bombing Exercise Air-to-Ground								0.65	0.65	0.5	2	0%	0%	100%	FDM	800	790	790	-10	-10
Strike Warfare	Gunnery Exercise Air-to-Ground								0.65	0.65	0.5	2	0%	0%	100%	FDM	50	100	100	50	50
Strike Warfare	Gunnery Exercise Air-to-Ground								0.65	0.65	0.5	2	0%	0%	100%	FDM	46	80	80	34	34
Strike Warfare	Missile Exercise Air-to-Ground								0.25	0.25	0.25	2	0%	0%	100%	FDM	15	15	15	0	0
Strike Warfare	Missile Exercise Air-to-Ground								0.25	0.25	0.25	2	0%	0%	100%	FDM	100	130	130	30	30
Other Training Exercises	Maritime Environmental Response	2.25	1.75	2.25	8	100%	0%	0%								Apra Harbor	0	1	1	1	1
Other Training Exercises	Maritime Environmental Response	2.25	1.75	2.25	8	33%	33%	34%								MIRC	0	1	1	1	1
Other Training Exercises	Underwater Survey	2.25	1.75	2.25	4	100%	0%	0%								MIRC	32	76	76	44	44
Other Training Exercises	Unmanned Aerial System Training and Certification				4	0%	50%	50%	0.65	0.65	0.5	6	0%	50%	50%	Guam	476	278	278	-198	-198
Other Training Exercises	Unmanned Aerial System Training and Certification only small boat, mostly in littorals/Apra. RHIBs from Guam, assume	2.25	1.75	2.25	4	0%	50%	50%	0.65	0.65	0.5	6	0%	50%	50%	Guam	476	278	278	-198	-198

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Activity Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect, startup and idle	Time to travel between shore location and range.	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range.	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
	all activity occurs near Guam																				
Other Training Exercises	Unmanned Underwater Vehicle Training – Certification and Development Exercises	2.25	1.75	2.25	4	50%	25%	25%	0.25	0.25	0.25	2	0%	50%	50%	MIRC	64	70	70	6	6
Other Training Exercises	Waterborne Training	2.25	1.75	2.25	4	50%	50%	0%								Guam	0	65	75	65	75

Table D-2: Proposed Changes to Testing Activities

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
						Distribution (%)							Distribution (%)								
Category	Activity Name	Time to prepare for shore disconnect - startup/idle (hr)	Time to travel between shore location and range, roundtrip (hr)	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	0–3 nm from shore	3–12 nm from Shore	>12 nm from Shore	Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range, roundtrip (hr)	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	0–3 nm from shore	3–12 nm from Shore	>12 nm from Shore	Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
Air Warfare	Air Combat Maneuver Test					0%	0%	100%	0.65	0.65	0.25	1	0%	0%	100%	MIRC	0	8	8	8	8
Air Warfare	Intelligence, Surveillance, and Reconnaissance Test								0.65	0.65	0.25	6	0%	0%	100%	MIRC	20	20	20	0	0
Anti-Submarine Warfare	Anti-Submarine Warfare Torpedo Test								0.65	0.65	0.25	6	0%	100%	0%	MIRC	20	10	10	-10	-10
Anti-Submarine Warfare	Anti-Submarine Warfare Tracking Test (Rotary-Wing)								0.65	0.65	0.25	6	0%	100%	0%	MIRC	26	5	5	-21	-21
Anti-Submarine Warfare	Anti-Submarine Warfare Tracking Test (Fixed-Wing)								0.65	0.65	0.25	6	0%	100%	0%	MIRC	26	3	3	-23	-23
Anti-Submarine Warfare	At-Sea Sonar Testing	2.25	1.75	2.25	2	0%	0%	100%								MIRC	7	12	12	5	5
Anti-Submarine Warfare	Pierside Sonar Testing	2.25	1.75	2.25	2	100%	0%	0%								Apra Harbor	0	12	12	12	12
Mine Warfare	Mine Countermeasure and Neutralization Testing	2.25	1.75	2.25	4	100%	0%	0%	0.65	0.65	0.25	2	100%	0%	0.0%	Agat Bay	3	3	3	0	0
Surface Warfare	Air-to-Surface Missile Test								0.65	0.65	0.25	2	0%	0%	100%	MIRC	4	7	7	3	3
Vessel Evaluation	In-Port Maintenance Testing	2.25	1.75	2.25	8	100%	0.0%	0.0%								Guam	0	12	12	12	12
Vessel Evaluation	Submarine Sea Trials – Weapons System Testing	2.25	1.75	2.25	2	0%	0%	100%								MIRC	1	1	1	0	0
Vessel Evaluation	Undersea Warfare Testing	2.25	1.75	2.25	2	0%	0%	100%	0.65	0.65	0.25	2	0%	0%	100%	MIRC	1	21	21	20	20
Vessel Evaluation	Vessel Signature Evaluation	2.25	1.75	2.25	2	100%	0.0%	0.0%								Guam	0	12	12	12	12
Unmanned Systems	Unmanned Aerial System Testing	2.25	1.75	2.25	4	100%	0%	0%	0.65	0.65	0.25	6	100%	0%	0%	Guam	0	2	2	2	2
Unmanned Systems	Unmanned Aerial System Testing	2.25	1.75	2.25	4	0%	0%	100%	0.65	0.65	0.25	6	0%	50%	50%	MIRC	0	2	2	2	2

		VESSELS							AIRCRAFT									Proposed Annual # of Events		Difference in Annual # of Events	
Category	Activity Name	Time to prepare for shore disconnect - startup/idle (hr)	Time to travel between shore location and range, roundtrip (hr)	Time to prepare for shore connect - idle/shutdown (hr)	Time on Range (hr)	Distribution (%)			Time to prepare for takeoff - startup/idle (hr)	Time to travel between shore location and range, roundtrip (hr)	Time for after landing activities - idle/shutdown (hr)	Time on Range (hr)	Distribution (%)			Location	Current Activities	ALT 1	ALT 2	ALT 1	ALT 2
						0–3 nm from shore	3–12 nm from Shore	>12 nm from Shore					0–3 nm from shore	3–12 nm from Shore	>12 nm from Shore						
Unmanned Systems	Unmanned Surface Vehicle System Testing	2.25	1.75	2.25	4	0%	50%	50%	0.65	0.65	0.25	2	0%	50%	50%	MIRC	0	1	1	1	1
Acoustic and Oceanographic Science and Technology	Acoustic and Oceanographic Research	2.25	1.75	2.25	8	0.0%	62%	38%	0.65	0.65	0.25	8	0%	62.0%	38.0%	MIRC	1	3	3	2	2

Table D-3: Aircraft Emission Factors

Aircraft	Engine Model	Engines (#)	Fuel Flow (lb/hr) /Engine	Fuel Flow (lb/hr) /Total	Fuel Flow (gal/hr)	Mode	CO	NOx	HC	VOC	SOx	PM	CO2	CO	NOx	VOC	SOx	PM	CO2	Source of Emissions Indices Information
AH-1W	T700-GE-401C (2)	2	425.1	850.2	127	Cruise	10.54	5.55	0.56	0.64	0.37	4.20	3216.27	8.96	4.72	0.55	0.31	3.57	2,734	AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table ES-2 and Table 2.
AH-1W	T700-GE-401C (2)	2	238.6	477	71	Warm up	22.49	4.29	0.98	1.13	0.37	4.20	3162.07	10.73	2.05	0.54	0.18	2.00	1,509	AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1
AH-1W	T700-GE-401C (2)	2	393.2	786	117	Taxi Out	11.70	9.66	1.55	1.78	0.37	4.20	3213.08	9.20	7.60	1.40	0.29	3.30	2,527	
AH-1W	T700-GE-401C (2)					Warm up/Taxi Out								19.93	9.64	1.94	0.47	5.31	4035.71	AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1
AH-1W	T700-GE-401C (2)	2	393	786	117	Taxi in	11.70	5.37	0.57	0.66	0.37	4.20	3213.08	9.20	4.22	0.52	0.29	3.30	2,527	AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1
AH-1W	T700-GE-401C (2)	2	164	328	49	shut down	39.81	3.28	2.54	2.92	0.37	4.20	3059.84	13.06	1.08	0.96	0.12	1.38	1,004	AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1
AH-1W	T700-GE-401C (2)					Taxi in/shut down								22.26	5.30	1.47	0.41	4.68	3530.39	AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1
AV-8B	F402-RR-408 (1)	1	6381	6381	952	approach	7.70	8.60	0.54	0.62	0.37	2.07	3144.00	49.13	54.88	3.96	2.36	13.21	20,062	AESO Memorandum Report No. 9913 Revision F, February 2019, Table 1
AV-8B	F402-RR-408 (1)	1	1137	1137	170	Start/Warm-up	106.30	1.80	19.66	22.61	0.37	2.18	2919.00	120.86	2.05	25.71	0.42	2.48	3,319	AESO Memorandum Report No. 9913 Revision F, February 2019, Table 1
AV-8B	F402-RR-408 (1)	1	1137	1137	170	Taxi out	106.30	1.80	19.66	22.61	0.37	2.18	2919.00	120.86	2.05	25.71	0.42	2.48	3,319	AESO Memorandum Report No. 9913 Revision F, February 2019, Table 1
AV-8B	F402-RR-408 (1)					Start/Warm-up Taxi out								241.73	4.09	51.41	0.84	4.96	6637.81	AESO Memorandum Report No. 9913 Revision F, February 2019, Table 1
AV-8B	F402-RR-408 (1)	1	1137	1137	170	On Runway	106.30	1.80	19.66	22.61	0.37	2.18	2919.00	120.86	2.05	25.71	0.42	2.48	3,319	AESO Memorandum Report No. 9913 Revision F, February 2019
AV-8B	F402-RR-408 (1)	1	1137	1137	170	Taxi-in/Shut down	106.30	1.80	19.66	22.61	0.37	2.18	2919.00	120.86	2.05	25.71	0.42	2.48	3,319	AESO Memorandum Report No. 9913 Revision F, February 2019
AV-8B	F402-RR-408 (1)					On Runway Taxi-in/Shut down								241.73	4.09	51.41	0.84	4.96	6637.81	AESO Memorandum Report No. 9913 Revision F, February 2019
C-130 F/R/T	T56-A-16 Turboprop	4	1125	4500	672	circle	2.07	8.16	0.47	0.54	0.37	3.97	3213.00	9.32	36.72	2.43	1.67	17.87	14,459	AESO Memorandum Report No. 2000-09D, December 2015.
CH-53	T64-GE-415 (3)	3	1488	4464	666	Cruise	2.13	8.08	0.15	0.17	0.37	2.21	3221.35	9.51	36.07	0.77	1.65	9.87	14,380	AESO Memorandum Report No. 9822 Revision E, November 2015
CH-53	T64-GE-415 (3)	3	269	807	120	Start up	74.33	2.12	28.25	32.49	0.37	2.21	3059.84	59.98	1.71	26.22	0.30	1.78	2,469	AESO Memorandum Report No. 9822 Revision E, November 2015
CH-53	T64-GE-415 (3)	3	607	1821	272	Warm up	15.83	3.93	8.79	10.11	0.37	2.21	3185.32	28.83	7.16	18.41	0.67	4.02	5,800	AESO Memorandum Report No. 9822 Revision E, November 2015
CH-53	T64-GE-415 (3)	3	695	2085	311	Taxi out	12.24	7.94	6.55	7.53	0.37	2.21	3197.49	25.52	16.55	15.71	0.77	4.61	6,667	AESO Memorandum Report No. 9822 Revision E, November 2015
CH-53	T64-GE-415 (3)					Start/Warm up/Taxi out								114.33	25.42	60.33	1.74	10.42	14936.53	AESO Memorandum Report No. 9822 Revision E, November 2015
CH-53	T64-GE-415 (3)	3	695	2085	311	Taxi in	12.24	4.42	6.55	7.53	0.37	2.21	3197.49	25.52	9.22	15.71	0.77	4.61	6,667	AESO Memorandum Report No. 9822 Revision E, November 2015
CH-53	T64-GE-415 (3)	3	269	807	120	shut down	74.33	2.12	28.25	32.49	0.37	2.21	3059.84	59.98	1.71	26.22	0.30	1.78	2,469	AESO Memorandum Report No. 9822 Revision E, November 2015
CH-53	T64-GE-415 (3)					Taxi in/shut down								85.50	10.93	41.92	1.07	6.39	9136.06	AESO Memorandum Report No. 9822 Revision E, November 2015

Aircraft	Engine Model	Engines (#)	Fuel Flow (lb/hr) /Engine	Fuel Flow (lb/hr) /Total	Fuel Flow (gal/hr)	Mode	CO	NOx	HC	VOC	SOx	PM	CO2	CO	NOx	VOC	SOx	PM	CO2	Source of Emissions Indices Information
CH-60	T700-GE-401C	2	600	1200	179	Cruise	6.25	6.40	0.55	0.63	0.37	4.20	3221.36	7.50	7.68	0.76	0.44	5.04	3,865	AESO Memorandum Report No. 9929 Revision D December 2019 , Table ES-2, VOC = THC x 1.15
CH-60	T700-GE-401C	2	273.93	548	82	Start/Warm up	18.65	4.60	0.77	0.89	0.37	4.20	3182.96	10.22	2.52	0.49	0.20	2.30	1,744	AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15
CH-60	T700-GE-401C	2	308.11	616	92	Taxi out	16.01	4.85	0.66	0.76	0.37	2.20	3196.08	9.87	2.99	0.47	0.23	1.36	1,969	AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15
CH-60	T700-GE-401C					Start/Warm up/Taxi out								20.08	5.51	0.95	0.43	3.66	3713.30	AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15
CH-60	T700-GE-401C	2	308.11	616	92	Taxi in/shut down	16.01	4.85	0.66	0.76	0.37	2.20	3196.08	9.87	2.99	0.47	0.23	1.36	1,969	AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15
EA-18G	F414-GE-400 (2)	2	5169	10338	1543	approach	0.72	14.75	0.12	0.14	0.37	6.56	3191.30	7.44	152.49	1.43	3.83	67.82	32,992	AESO Memorandum Report No. 9815 I, June 2017, Table 5
EA-18G	F414-GE-400 (2)	2	695	1390	207	Start/Warm-up	98.18	3.18	65.33	75.13	0.37	12.64	2973.00	136.47	4.42	104.43	0.51	17.57	4,132	AESO Memorandum Report No. 9815 I, June 2017, Table 5
EA-18G	F414-GE-400 (2)	2	695	1390	207	Taxi Out	98.18	3.18	65.33	75.13	0.37	12.64	2973.00	136.47	4.42	104.43	0.51	17.57	4,132	AESO Memorandum Report No. 9815 I, June 2017, Table 5
EA-18G	F414-GE-400 (2)					Start/Warm-up/Taxi Out								272.94	8.84	208.86	1.03	35.14	8264.94	AESO Memorandum Report No. 9815 I, June 2017, Table 5
EA-18G	F414-GE-400 (2)	2	695	1390	207	On Runway	98.18	3.18	65.33	75.13	0.37	12.64	2973.00	136.47	4.42	104.43	0.51	17.57	4,132	AESO Memorandum Report No. 9815 I, June 2017, Table 5
EA-18G	F414-GE-400 (2)	2	695	1390	207	Taxi in	98.18	3.18	65.33	75.13	0.37	12.64	2973.00	136.47	4.42	104.43	0.51	17.57	4,132	AESO Memorandum Report No. 9815 I, June 2017, Table 5
EA-18G	F414-GE-400 (2)					On Runway/Taxi in								272.94	8.84	208.86	1.03	35.14	8264.94	AESO Memorandum Report No. 9815 I, June 2017, Table 5
F-15E	F100-PW-229 (2)	2	3098	6196	925	approach	1.17	15.08	na	0.24	0.37	0.70	3200.00	7.25	93.44	1.49	2.29	4.34	19,827	Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
F-15E	F100-PW-229 (2)	2	1087	2174	324	Idle (Taxi)	10.17	3.80		0.45	0.37	0.67		22.11	8.26	0.98	0.80	1.46		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
F-16	F100-PW-100	1	2765	2765	413	approach	3.99	12.52		1.06	0.37	1.57		11.03	34.62	2.93	1.02	4.34		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
F-16	F100-PW-100	1	1127	1127	168	Idle (Taxi)	49.58	4.64		3.79	0.37	3.13		55.88	5.23	4.27	0.42	3.53		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
F-22	F119-PW-100	2	2740	5480	818	approach	7.92	6.59		0.05	0.37	1.96	3156.00	43.40	36.11	0.27	2.03	10.74	17,295	AESO Memorandum Report No. 2020-08, July 2020
F-22	F119-PW-100	2	1377	2754	411	Taxi/Idle out Taxi/Idle in	48.15	3.01		1.67	0.37	2.42	3156.00	132.61	8.29	4.60	1.02	6.66	8,692	AESO Memorandum Report No. 2020-08, July 2020, Table 1
FA-18E/F	F414-GE-400 (2)	2	5169	10338	1543	approach	0.72	14.75	0.12	0.14	0.37	6.56	3191.30	7.44	152.49	1.43	3.83	67.82	32,992	AESO Memorandum Report No. 9815 I, June 2017, Table 5
FA-18E/F	F414-GE-400 (2)	2	695	1390	207	Warm up	98.18	3.18	65.33	75.13	0.37	12.64	2973.00	136.47	4.42	104.43	0.51	17.57	4,132	AESO Memorandum Report No. 9815 I, June 2017, Table 5
FA-18E/F	F414-GE-400 (2)	2	695	1390	207	Taxi Out	98.18	3.18	65.33	75.13	0.37	12.64	2973.00	136.47	4.42	104.43	0.51	17.57	4,132	AESO Memorandum Report No. 9815 I, June 2017, Table 5
FA-18E/F	F414-GE-400 (2)					Warm up /Taxi Out								272.94	8.84	208.86	1.03	35.14	8264.94	AESO Memorandum Report No. 9815 I, June 2017, Table 5
FA-18E/F	F414-GE-400 (2)	2	695	1390	207	On Runway	98.18	3.18	65.33	75.13	0.37	12.64	2973.00	136.47	4.42	104.43	0.51	17.57	4,132	AESO Memorandum Report No. 9815 I, June 2017, Table 5
FA-18E/F	F414-GE-400 (2)	2	695	1390	207	Taxi in	98.18	3.18	65.33	75.13	0.37	12.64	2973.00	136.47	4.42	104.43	0.51	17.57	4,132	AESO Memorandum Report No. 9815 I, June 2017, Table 5
FA-18E/F	F414-GE-400 (2)					On Runway/Taxi in								272.94	8.84	208.86	1.03	35.14	8264.94	AESO Memorandum Report No. 9815 I, June 2017, Table 5

Aircraft	Engine Model	Engines (#)	Fuel Flow (lb/hr) /Engine	Fuel Flow (lb/hr) /Total	Fuel Flow (gal/hr)	Mode	CO	NOx	HC	VOC	SOx	PM	CO2	CO	NOx	VOC	SOx	PM	CO2	Source of Emissions Indices Information
F-35 (surrogate)	F119-PW-100	1	2740	2740	409	approach	7.92	6.59		0.05	0.37	1.96	3156.00	21.70	18.06	0.14	1.01	5.37	8,647	AESO Memorandum Report No. 2020-08, July 2020
F-35 (surrogate)	F119-PW-100	1	1377	1377	206	Taxi/Idle out Taxi/Idle in	48.15	3.01		1.67	0.37	2.42	3156.00	66.30	4.14	2.30	0.51	3.33	4,346	AESO Memorandum Report No. 2020-08, July 2020, Table 1
KC-135	J57-P-22	4	1693	6772	1011	approach	23.51	2.95		14.26	0.37	5.32		159.21	19.98	96.57	2.51	36.03		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
KC-135	J57-P-22	4	1087	4348	649	Taxi/Idle out Taxi/Idle in	59.25	2.48		59.03	0.37	7.64		257.62	10.78	256.66	1.61	33.22		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
Learjet	TFE731-2-2B	2	532	1064	159	approach	22.38	5.90	4.26	4.90	0.37	0.09	3200.00	23.81	6.28	5.21	0.39	0.10	3,405	Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
Learjet	TFE731-2-2B	2	190	380	57	Taxi/Idle Out	58.600	2.820		23.050	0.370	0.130		22.27	1.07	8.76	0.14	0.05		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
Learjet	TFE731-2-2B	2	190	380	57	Taxi In/ shut down	58.60	2.82		23.05	0.37	0.13		22.27	1.07	8.76	0.14	0.05		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
MV-22	T406-AD-400	2	1910	3820	570	Cruise	0.52	14.09	0.01	0.01	0.37	1.57	3209.16	1.99	53.82	0.04	1.41	6.00	12,259	AESO Memorandum Report No. 9946 Revision G May 2017, Table ES-2, VOC = THC x 1.16 x 1.15
MV-22	T406-AD-400	2	360	720	107	Start/Warm up	8.90	4.09	0.10	0.12	0.37	1.57	3221.00	6.41	2.94	0.08	0.27	1.13	2,319	AESO Memorandum Report No. 9946 Revision G May 2017, Table 2, VOC = THC x 1.16 x 1.15
MV-22	T406-AD-400	2	360	720	107	Cool/Shut down	8.90	4.09	0.10	0.12	0.37	1.57	3221.00	6.41	2.94	0.08	0.27	1.13	2,319	AESO Memorandum Report No. 9946 Revision G May 2017, Table 2, VOC = THC x 1.16 x 1.15
MQ-4C	AE3007H	1	929	929	139	Approach	3.28	7.79		0.74	0.37	0.07		3.05	7.24	0.69	0.34	0.07		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
MQ-4C (Idle)	AE3007H	1	389	389	58	Idle	17.35	3.83		2.89	0.37	0.05		6.75	1.49	1.12	0.14	0.02		Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants
P-8 MMA	Boeing 737-800 Series CFM56-7B27	2	2770	5540	827	approach	1.41	11.00	0.10	0.12	0.37	0.09	3161.00	7.81	60.94	0.64	2.05	0.49	17,512	AESO Memorandum Report No. 2017-09, April 2017
P-8 MMA	Boeing 737-800 Series CFM56-7B27	2	921	1842	275	Warm up	17.90	4.80	1.70	1.96	0.37	0.07	3161.00	32.97	8.84	3.60	0.68	0.13	5,823	AESO Memorandum Report No. 2017-09, April 2017
P-8 MMA	Boeing 737-800 Series CFM56-7B27	2	921	1842	275	Taxi Out	17.90	4.80	1.70	1.96	0.37	0.07	3161.00	32.97	8.84	3.60	0.68	0.13	5,823	AESO Memorandum Report No. 2017-09, April 2017
P-8 MMA	Boeing 737-800 Series CFM56-7B27					Warm up /Taxi Out								65.94	17.68	7.20	1.36	0.25	11645.12	AESO Memorandum Report No. 2017-09, April 2017
P-8 MMA	Boeing 737-800 Series CFM56-7B27	2	4946	9892	1476	On Runway	0.53	4.80	0.08	0.09	0.37	0.163	3161.00	5.24	47.48	0.91	3.66	1.61	31,269	AESO Memorandum Report No. 2017-09, April 2017
P-8 MMA	Boeing 737-800 Series CFM56-7B27	2	921	1842	275	Taxi in	17.90	15.94	1.70	1.96	0.37	0.068	3161.00	32.97	29.36	3.60	0.68	0.13	5,823	AESO Memorandum Report No. 2017-09, April 2017
P-8 MMA	Boeing 737-800 Series CFM56-7B27					On Runway/Taxi in								38.21	76.84	4.51	4.34	1.74	37091.17	AESO Memorandum Report No. 2017-09, April 2017
SH-60	T700-GE-401C (2)	2	600	1200	179	Cruise	6.25	6.40	0.55	0.63	0.37	4.20	3221.36	7.50	7.68	0.76	0.44	5.04	3,866	AESO Memorandum Report No. 9929, Revision B, January
SH-60	T700-GE-401C	2	273.93	548	82	Start/Warm up	18.65	4.60	0.77	0.89	0.37	4.20	3182.96	10.22	2.52	0.49	0.20	2.30	1,744	AESO Memorandum Report No. 9929 Revision D
SH-60	T700-GE-401C	2	308.11	616	92	Taxi out	16.01	4.85	0.66	0.76	0.37	4.20	3196.08	9.87	2.99	0.47	0.23	2.59	1,969	AESO Memorandum Report No. 9929 Revision D
SH-60	T700-GE-401C					Start/Warm up/Taxi out								20.08	5.51	0.95	0.43	4.89	3713.30	AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15
SH-60	T700-GE-401C (2)	2	308	616	92	Taxi in/shut down	16.01	4.85	0.66	0.76	0.37	4.20	3196.08	9.87	2.99	0.47	0.23	2.59	1,969	AESO Memorandum Report No. 9929 Revision D, December 2019 ,Table 1, VOC = THC x 1.15

							Emissions (lb/op)							
		Engines (#)	Fuel Flow (lb/op)		Fuel Flow (gal/op)	Mode	CO	NOx	HC	VOC	SOx	PM	CO2	Source of Emissions Indices Information
F-35	F135-PW-400	1	1057		158	Military Takeoff	12.09	8.42	0.02	0.02	0.39	0.13	3336.76	AESO Memorandum Report No. 2017-18 Revision A, December 2017, Table 1, F-35C Variant
F-35	F135-PW-400	1	1220		182	Straight In Arrival	13.52	6.43	0.02	0.023	0.45	0.15	3849.45	AESO Memorandum Report No. 2017-18 Revision A, December 2017, Table 1, F-35C Variant
F-35	F135-PW-400	1	629		94	Touch and Go - Carrier Pattern	0.47	9.96	0.003	0.003	0.23	0.08	1986.01	AESO Memorandum Report No. 2017-18 Revision A, December 2017, Table 1, F-35C Variant
						Sum	26.08	24.81	0.04	0.05	1.07	0.36	9172.22	

Table D-4: Vessel Emission Factors

Vessel		VESSEL SPECIFICATIONS				EMISSIONS FACTORS (LB/HR)										
		Propulsion	Output (HP)	No.	Max Power (HP)	CO	NOx	HC	SOx	SOx Adjusted for JP-5	PM10	PM2.5	CO2	Fuel Consumption at Speed (gal/hr)	CO2, LB/HR	Reference for Fuel Consumption Rate
Cruiser	CG-72 Underway	GE LM 2500	21,500	4	86,000	61.51	79.58	4.32	0.23	2.80	0.997	0.997	24,188	1159.20	24,188	Fuel flow rate calculated based on the SOx emission
	CG- 72 RW					27.73	285.54	2.46	0.47	5.64	4.38	4.38	69,839	2338.31	69,839	
	CG- 72 Not Underway					1.54	10.05	0.28	0.02	0.18	0.10	0.10	3,057	74.63	3,057	
Destroyer	DDG-100 Underway	GE LM 2500	21,500	4	86,000	59.72	114.52	4.01	0.27	3.19	0.14	0.14	27,565	1323.38	27,565	Fuel flow rate calculated based on the SOx emission
	DDG-100 - RW					30.57	374.80	2.39	0.58	6.90	0.54	0.54	85,141	2860.70	85,141	
	DDG-100 Not Underway					0.36	25.65	0.04	0.02	0.22	0.12	0.12	3,669	89.55	3,669	
T-AOE	T-AOE-6 Underway	GE LM 2500	26,250	4	105,000	109.76	311.31	10.60	0.36	4.32	3.43	3.43	67,945	1791.04	67,945	Fuel flow rate calculated based on the SOx emission factor
	T-AOE- - RW					35.08	445.24	5.85	0.57	6.88	5.32	5.32	81,478	2850.75	81,478	
	T-AOE-6 Not Underway					2.61	60.87	1.77	0.02	0.20	0.10	0.10	1,838	84.58	1,838	
USCG Cutter WHEC715, 378 feet - Hamilton Class	USCG	Fairbanks Morse T88-1-8, 3,600 hp	3600	2	7200	5.74	57.91	0.88	0.078	0.94	0.21	0.21	8,354	371.13	8,354	Fuel flow rate calculated based on the SOx emission factor
Amphibious Assault Ship - Tarawa	LHA-6 Underway	Steam Combustion Engineering		3		8.38	277.87	14.48	0.29	3.43	4.94	4.94	35,922	1422.89	35922.08	
	LHA-6 -RW					18.73	199.99	15.15	0.21	2.46	3.38	3.38	28,059	1019.90	28059.16	
	LHA-6 Not Underway					5.38	243.95	7.51	0.27	3.24	4.94	4.94	33,863	1343.28	33863.00	
Landing Helicopter Dock	LHD-2 Underway	ALCO 16-251C	2,800	2	5,600	8.08	47.83	5.77	0.41	4.87	28.58	28.58	47,633	2019.90	47,633	Fuel flow rate calculated based on the SOx emission factor
	LHD-2 - RW					7.66	45.12	5.72	0.41	4.86	28.55	28.55	47,490	2014.93	47,490	
	LHD-2 Not Underway					2.93	16.25	2.20	0.16	1.87	10.98	10.98	18,261	776.12	18,261	

Vessel		VESSEL SPECIFICATIONS				EMISSIONS FACTORS (LB/HR)										
		Propulsion	Output (HP)	No.	Max Power (HP)	CO	NOx	HC	SOx	SOx Adjusted for JP-5	PM10	PM2.5	CO2	Fuel Consumption at Speed (gal/hr)	CO2, LB/HR	Reference for Fuel Consumption Rate
Amphibious Transport Dock	LPD-17 Underway	turbocharged marine Colt-Pielstick Diesels			41,600	31.61	272.28	16.86	0.16	1.92	1.36	1.36	16,767.15	796.02	16767.15	Navy database
	LPD-17 - RW					28.08	263.75	14.95	0.14	1.69	1.12	1.12	15,025.58	701.49	15025.58	
	LPD-17 Not Underway					2.57	31.80	1.74	0.02	0.20	0.10	0.10	1,814.00	84.58	1814.00	
Landing Craft, Air Cushion	LCAC-91	TF40B	3955	4		18.32	114.54	3.49	0.16	1.97	2.33	2.33	20,693.35	815.92	20693.35	Navy database
Mine Counter Measures	MCM -14	ID36SS6V-AM(M)	600	4	2400	3.49	28.97	2.61	0.02	0.18	0.33	0.33	1,781	74.63	1,781	Fuel flow rate calculated based on the SOx emission
	MCM - RW					4.17	35.05	3.35	0.02	0.22	0.36	0.36	2,174	89.55	2,174	
	MCM Not Underway					0.59	5.09	0.63	0.00	0.04	0.06	0.06	378	14.93	378	Fuel flow rate calculated based on the SOx emission factor
Landing Craft Utility	LCU	12V-71 7122-7000	425	2		5.06	15.704	1.274	0.01	0.11	0.604	0.60	923.57	44.78	923.57	
	AAV-2 (used for ACV)	400 hp				0.76	6.22	0.82	0.01	0.16	0.26	0.25	1389.56	67.00	1389.56	Sox emission factor, in lb/hr, was calculated based on the fuel flow rate and ULS fuel sulfur content.
	PC-14					37.357	74.18	6.02	0.07	0.84	1.397	1.36	7676.62	348.26	7676.62	
	PC-14-RW					43.153	78.36	7.22	0.08	0.90	1.466	1.42	8054.32	373.13	8054.32	
	PB					42.417	81.81	1.88	0.05	0.64	3.327	3.23	6172.34	263.68	6172.34	
	MK V-2	2,285 hp				3.86	29.49	0.99	4.73	56.76	0.40	0.40		23532.34	14	
Rigid Inflatable Boat	RIB-4	QSB5.9M TIER 2	230	1	230	1.88	2.677	0.062	0.00	0.02	0.047	0.047	265.182	9.95	265.18	Navy database
	CRRC-5					0.2242	0.9538	0.0128	0.00	0.01	0.0289	0.03	87.23	2.49	87.23	Atlantic Fleet Training and Testing Final EIS/OEIS, September 2018
	AE-2					20.17	20.93	0.99	5.97	71.64	1.57	1.57		29701.49		
	LCS -1 Underway	Rolls-Royce MT30 36	48000	2	96000	46.14	186.77	3.19	0.21	2.54	0.41	0.41	25,512	1054.73	25,512	Fuel flow rate calculated based on the SOx emission factor
	LCS - RW					79.12	152.60	6.12	0.10	1.19	0.62	0.62	11,116	492.54	11,116	
	LCS -1 Not Underway					4.59	8.86	0.20	0.01	0.07	0.36	0.36	647	29.85	647	

Vessel		VESSEL SPECIFICATIONS				EMISSIONS FACTORS (LB/HR)										
		Propulsion	Output (HP)	No.	Max Power (HP)	CO	NOx	HC	SOx	SOx Adjusted for JP-5	PM10	PM2.5	CO2	Fuel Consumption at Speed (gal/hr)	CO2, LB/HR	Reference for Fuel Consumption Rate
	LSD-52 Underway					21.25	334.51	10.84	0.11	1.26	0.91	0.91	16263.96	522.39	16,264	
	LSD-52-RW					40.02	604.28	20.43	0.19	2.33	1.68	1.68	21,126	965.17	21,126	
	LSD-52 Not Underway					1.27	39.79	0.85	0.01	0.12	0.09	0.09	1,407	49.75	1,407	
	SSN Underway					3.24	2.39	0.17	0.00	0.01	0.01	0.01	112.62	4.98	112.62	
	SSN - RW					0.32	0.23	0.02	0.00	0.01	0.001	0.00	11.06	4.98	11.06	
	SSN Not Underway					0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.00	0.00	
	CVN-74 Underway					1.23	16.73	0.31	0.01	0.07	0.05	0.05	683.62	29.85	683.62	Fuel flow rate calculated based on the SOx emission
	CVN - RW					0.12	1.65	0.03	0.00	0.01	0.005	0.005	67.61	4.98	67.61	
	CVN-74 Not Underway					0.03	0.41	0.01	0.00	0.00	0.06	0.06	17.00	0.000	17.00	Fuel flow rate calculated based on the SOx emission

Notes:

1. Navy and MSC Marine Engine Fuel Consumption & Emission Calculator was used to update the emission factors.
2. All SO_x emission factors are based on F-76 (Marine Diesel) with a sulfur content of 0.0015%.
3. RW = Restricted Waters

Typical JP-5 sulfur content	0.018%	Source: AESO Memorandum Report No. 2012-01 Revision H, Table 1
Adjust ment for sulfur conten	12	
Average brake specific fuel	7000	btu/hp
diesel heating value	19,400	btu/lb
Average brake specific fuel consumption	0.36	lb/hp
Average diesel density	7.00	lb/gal
Average brake specific fuel consumption	0.052	gal/hp
Diesel Sulfur Content	0.0015%	

Table D-5: Munitions Emission Factors

Munitions Information						Emission Factor (lb/item)						
Munition Type	**Munition**	**Component**	**Net Explosive Weight (lb NEW)**	**Reference**	**Emission Factor Assumptions and Comments**	**CO**	**NO_x**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**
BOMB	MK82 INERT	spotting charge	3	Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018	Assume Spotting Charge	0.26						
BOMB	MK82 HE			Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018	Calculate for 192 lb of PEP. 80% TNT, 20% Aluminum; TNT EF x 80% used; Data available in TR-83-240.	60.00						
BOMB	MK84			MITT Phase III		140.00						
C4			1	Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018		0.02625	0.007875		0.02625	0.01875		
LRG PROJ	155MM ILL		6	AP-42 Chapter 15, Table 15.4.1-1 EMISSION FACTORS FOR THE USE OF DODIC D505, M485A2 155-MM ILLUMINATION ROUND (PROJECTILE)		0.026	0.094	0.0015	3		0.0027	1.8
LRG PROJ	5.56					1.60E-03	8.50E-05		3.90E-05	2.80E-05		8.70E-04
MED PROJ	30MM		0.03	AP 42, Chapter 15, Table 15.2.1-1 EMISSION FACTORS FOR THE USE OF DODIC B129, M789 30-MM HIGH EXPLOSIVE DUAL PURPOSE		0.00086	0.0002		0.0039	0.0025	0	0.0044
SML PROJ	7.62					2.30E-03	9.70E-05		5.10E-05	3.80E-05		1.20E-03
SMOKE POT	ABC-M5 30-POUND HC SMOKE POT		1.10	AP 42, Chapter 15, Table 15.7.6-1, EMISSION FACTORS FOR THE USE OF DODIC K866, ABC-M5 30-POUND HC SMOKE POT	Net Explosive Weight for Smokey Sam is from Hazard Classification of United States Military Explosives and Munitions, Revision 15, June 2012	0.0275	0.0000924	0.000594	1.1	0.616	0.000154	0.0165
MISSILE	AIM-7	Fired well above 3,000 ft		Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018								
MISSILE	AGM-84		215	AP 42, Chapter 15, Table 15.9.1-1, DODIC M023, M112 Demolition Block Charge	Assume similar to C-4 emissions. Net Explosive Weight for AGM -84 is from Hazard Classification of United States Military Explosives and Munitions, Revision 15, June 2012	4.515	1.3545		4.515	3.225	0.0258	135.45
MISSILE	AGM-114B					0.7224	0.21672	0	0.7224	0.516	0.004128	
MISSILE	AGM-65 Maverick					2.1	0.63	0	2.1	1.5	0.012	
MISSILE	AGM-84					4.515	1.3545	0	4.515	3.225	0.0258	
MISSILE	AGM-88 HARM					1.008	0.3024	0	1.008	0.72	0.00576	
MISSILE	SM-3					630			1200	1200		69.6
Rocket	2.75" RKT HE	warhead		Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018		0.93	0.0056		0.4	0.29		5.5
Rocket	2.75" RKT Inert	INERT Warhead	Neg.	Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018		Negligible emissions						
TORPEDO	MK30	No emissions										
	MK46	No emissions										
	MK54	No emissions										

Table D-6: ALT 1 – Summary of Emission Changes

Total Change in Annual Emissions for At-Sea and FDM Training and Testing Activities, Alternative 1

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_X	PM_{10}	$PM_{2.5}$
Aircraft	-71.10	181.61	-54.46	5.30	20.88	20.88
Vessel	72.36	324.73	16.95	6.01	10.95	10.92
Munitions	-52.07	-0.02	0.00	0.00	-0.17	-0.12
Range Modernization and Sustainment	0.015	0.021	0.000496	0.000192	0.0004	0.0004
Total Change in Emissions, TPY	-50.79	506.35	-37.51	11.31	31.66	31.68

Change in Annual Emissions for Training and Testing Activities Within 3 Nautical Miles, Guam, Alternative 1

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_X	PM_{10}	$PM_{2.5}$
Aircraft	-19.80	45.97	-1.78	1.31	8.01	8.01
Vessel	24.42	171.64	9.17	2.86	7.18	7.16
Munitions	0.00	0.00	0.00	0.00	0.00	0.00
Range Modernization and Sustainment	0.015	0.021	0.0005	0.0002	0.0004	0.0004
Total Change in Emissions, TPY	4.64	217.64	7.39	4.17	15.20	15.18
de minimis threshold	N/A	N/A	N/A	100	N/A	N/A
Exceeds threshold?	**No**	**No**	**No**	**No**	**No**	**No**

Change in Annual Emissions for At-Sea and FDM Training and Testing Activities Within 12 Nautical Miles, Alternative 1

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_X	PM_{10}	$PM_{2.5}$
Aircraft	-455.80	172.66	-317.19	3.94	-22.15	-22.15
Vessel	5.73	226.41	13.99	2.64	12.42	12.40
Munitions						
Range Modernization and Sustainment	0.015	0.021	0.0005	0.0002	0.0004	0.0004
Total Change in Emissions, TPY	-450.06	399.09	-303.19	6.57	-9.73	-9.75

Change in Annual Emissions for At-Sea and FDM Training and Testing Activities Greater Than 12 Nautical Miles, Alternative 1

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_X	PM_{10}	$PM_{2.5}$
Aircraft	384.70	8.96	262.73	1.36	43.04	43.04
Vessel	66.64	98.32	2.96	3.37	-1.48	-1.48
Munitions	-52.07	-0.02	0.00	0.00	-0.17	-0.12
Range Modernization and Sustainment	0	0	0	0	0	0
Total Change in Emissions, TPY	399.3	107.3	265.7	4.7	41.4	41.4

Table D-7: ALT 2 – Summary of Emission Changes

Total Change in Annual Emissions for At-Sea and FDM Training and Testing Activities, Alternative 2

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_X	PM_{10}	$PM_{2.5}$
Aircraft	-71.10	181.61	-54.46	5.30	20.88	20.88
Vessel	72.36	324.73	16.95	6.01	10.95	10.92
Munitions	-48.76	-0.01	0.00	0.00	0.05	0.04
Range Modernization and Sustainment	0.015	0.021	0.000496	0.000192	0.0004	0.0004
Total Change in Emissions, TPY	-47.48	506.36	-37.51	11.31	31.88	31.84

Change in Annual Emissions for Training and Testing Activities Within 3 Nautical Miles, Guam, Alternative 2

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_X	PM_{10}	$PM_{2.5}$
Aircraft	-19.80	45.97	-1.78	1.31	8.01	8.01
Vessel	24.42	171.64	9.17	2.86	7.18	7.16
Munitions	0.00	0.00	0.00	0.00	0.00	0.00
Range Modernization and Sustainment	0.015	0.021	0.0005	0.0002	0.0004	0.0004
Total Change in Emissions, TPY	4.64	217.64	7.39	4.17	15.20	15.18
de minimis threshold	N/A	N/A	N/A	100	N/A	N/A
Exceeds threshold?	**No**	**No**	**No**	**No**	**No**	**No**

Change in Annual Emissions for At-Sea and FDM Training and Testing Activities Within 12 Nautical Miles, Alternative 2

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_X	PM_{10}	$PM_{2.5}$
Aircraft	-455.80	172.66	-317.19	3.94	-22.15	-22.15
Vessel	5.73	226.41	13.99	2.64	12.42	12.40
Munitions						
Range Modernization and Sustainment	0.015	0.021	0.0005	0.0002	0.0004	0.0004
Total Change in Emissions, TPY	-450.06	399.09	-303.19	6.57	-9.73	-9.75

Change in Annual Emissions for At-Sea and FDM Training and Testing Activities Greater Than 12 Nautical Miles, Alternative 2

Source	Emissions by Air Pollutant (TPY)					
	CO	NO_X	VOC	SO_X	PM_{10}	$PM_{2.5}$
Aircraft	384.70	8.96	262.73	1.36	43.04	43.04
Vessel	66.64	98.32	2.96	3.37	-1.48	-1.48
Munitions	-48.76	-0.01	0.00	0.00	0.05	0.04
Range Modernization and Sustainment	0	0	0	0	0	0
Total Change in Emissions, TPY	402.6	107.3	265.7	4.7	41.6	41.6

REFERENCES

Air Force Civil Engineer Center. (2023). *Air Emissions Guide for Air Force Mobile Sources: Methods for Estimating Emissions of Air Pollutants for Mobile Sources at United States Air Force Installations*. JBSA Lackland, TX: Compliance Technical Support Branch.

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U.S. Environmental Protection Agency. (2025). *Current Nonattainment Counties for All Criteria Pollutants*. Retrieved January 28, 2026, from https://www3.epa.gov/airquality/greenbook/ancl.html.

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ATTACHMENT

Record of Non-Applicability for Clean Air Act Conformity

The Proposed Action falls under the Record of Non-Applicability (RONA) category and is documented with this RONA.

Introduction

The United States Environmental Protection Agency (USEPA) published Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule, in November 30, 1993, Federal Register (40 Code of Federal Regulations [CFR] Parts 6, 51, and 93). On April 5, 2010, the USEPA finalized revisions to the General Conformity Rule (75 Federal Register 17253–17279).

Federal regulations state that "no department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity that does not conform to an applicable State Implementation Plan." It is the responsibility of the federal agency to determine whether a federal action conforms to the applicable State Implementation Plan before the action is taken (40 CFR Part 51.850[a]).

Federal actions may be exempt from conformity determinations if their emissions do not exceed designated *de minimis* levels for the criteria pollutants of nonattainment or maintenance in the areas of the federal action (40 CFR Part 51.853[b]).

Proposed Action

Action Proponent: Department of the Navy (Navy)

Proposed Action Name: Mariana Islands Training and Testing (MITT) Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS)

Date RONA Prepared: January 23, 2026

RONA Prepared by: ManTech International

Proposed Action and Emissions Summary:

The U.S. Department of the Navy (including both the Navy and the U.S. Marine Corps), as the lead agency, jointly with the U.S. Coast Guard, the Army, and the U.S. Air Force, proposes to continue to conduct training activities (hereinafter referred to as "training"); research, development, testing, and evaluation activities (hereinafter referred to as "testing"); and modernization and sustainment of ranges in the MITT Study area. This analysis is a supplement to the 2015 EIS/OEIS and Record of Decision (ROD) and the 2020 SEIS/OEIS and ROD, pursuant to the guidance of 40 CFR section 1502.9(c) (2019). A General Conformity Evaluation is triggered for the Proposed Action because some of the proposed activities occur within the Guam nonattainment areas for the sulfur dioxide (SO_2) National Ambient Air Quality Standards. Table 1 presents the estimated emissions within these areas for Alternative 1 (Preferred Alternative) and compares the emissions to the applicable General Conformity Rule *de minimis* threshold. As shown, the total emissions are well below all applicable thresholds. As such, a conformity determination is not required for the Proposed Action.

Table 1: Estimated Increase in Emissions within the Guam SO_2 Nonattainment Areas[1]

Source	SO_X[1] Emissions Increase (TPY)
Aircraft	1.31
Vessel	2.86
Munitions	0.00
Range Modernization and Sustainment	<0.001
Total Change in Emissions, TPY	4.17
de minimis threshold	100
Exceeds threshold?	**No**

[1] Sulfur oxides (SO_x) are a broader category that includes sulfur dioxide (SO_2) and other sulfur-oxygen compounds. For this analysis, the *de minimis level for* SO_2 is conservatively compared to SO_x emissions.

Proposed Action Exemptions

The Proposed Action is exempt from the General Conformity Rule requirements, based on the determination that the emissions are well below the *de minimis* level for all applicable pollutants.

Emissions Evaluation Conclusion

The Department of the Navy concludes the *de minimis* level for SO_2 would not be exceeded as a result of implementing the Proposed Action. The emissions data supporting that conclusion are shown in Table 1. The calculations, methodology, data, and references are contained in the Air Quality Impact Study presented in Appendix D of the SEIS/OEIS. Therefore, the Department of Navy concludes that further formal Conformity Determination procedures are not required, resulting in this RONA.

RONA Approval

Signature:_____

Name / Rank:_____

Date:_____

Position:_____