3.2 Air Quality

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3.2 AIR QUALITY

AIR QUALITY SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following have been analyzed for air quality:

- Criteria pollutants
- Hazardous air pollutants

Preferred Alternative (Alternative 1)

- All reasonably foreseeable direct and indirect emissions of criteria pollutants in nonattainment and maintenance areas would not equal or exceed applicable *de minimis* levels.
- The public would not be exposed to substantial concentrations of hazardous air pollutants.

3.2.1 INTRODUCTION AND METHODS

3.2.1.1 Introduction

Air pollution can threaten public health and damage the environment (U.S. Environmental Protection Agency 2007). Congress passed the Clean Air Act (CAA) and its amendments, which set regulatory limits on air pollutant emissions and help to ensure basic public health and environmental protection from air pollution. Air pollution damages trees, crops, other plants, lakes, and animals. In addition to damaging the natural environment, air pollution damages the exteriors of buildings, monuments, and statues. It can create haze or smog that reduces visibility in national parks and cities or that interferes with aviation.

Air quality is defined by atmospheric concentrations of specific air pollutants—pollutants the United States (U.S.) Environmental Protection Agency (USEPA) determined may affect the health or welfare of the public. The six major pollutants of concern, called "criteria pollutants," are carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), suspended particulate matter (PM), and lead (Pb). Suspended particulate matter is further categorized as particulates less than or equal to 10 microns in diameter (PM_{10}) and fine particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$). The USEPA established National Ambient Air Quality Standards for these criteria pollutants.

In addition to the six criteria pollutants, the USEPA designated 188 substances as hazardous air pollutants under the federal CAA. Hazardous air pollutants are air pollutants known to cause or suspected of causing cancer or other serious health effects, or adverse environmental effects (U.S. Environmental Protection Agency 2010). National Ambient Air Quality Standards have not been established for these pollutants. However, the USEPA has developed rules that limit emissions of hazardous air pollutants from specific industrial sources. These emissions control standards are known as "maximum achievable control technologies" and "generally achievable control technologies." They are intended to achieve the maximum degree of reduction in emissions of hazardous air pollutants, taking into consideration the cost of emissions control, non-air quality health and environmental impacts, and energy requirements. Examples of hazardous air pollutants include benzene, which is found in gasoline; perchloroethene, which is emitted from some dry cleaning facilities; and methylene chloride, a solvent and paint stripper used in some industries. Hazardous air pollutants are regulated

under the CAA's National Emission Standards for Hazardous Air Pollutants, which apply to specific sources of hazardous air pollutants, and under the Urban Air Toxics Strategy, which applies to area sources.

Air pollutants are classified as either primary or secondary pollutants, based on how they are formed. Primary air pollutants are emitted directly into the atmosphere from the source and retain their chemical form. Examples of primary pollutants are the CO produced by a power plant burning fuel and volatile organic compounds emitted by a dry cleaner (U.S. Environmental Protection Agency 2010). Secondary air pollutants are those formed through atmospheric chemical reactions—reactions that usually involve primary air pollutants (or pollutant precursors) and normal constituents of the atmosphere (U.S. Environmental Protection Agency 2010). O_3, a major component of photochemical smog, is a secondary air pollutant. O_3 precursors consist of two groups of chemicals: nitrogen oxides (NO_X) and organic compounds. NO_X consists of nitric oxide (NO) and NO_2. Organic compound precursors of O_3 are routinely described by various terms, including volatile organic compounds, reactive organic compounds, and reactive organic gases. Finally, some air pollutants are a combination of primary and secondary pollutants. PM_{10} and $PM_{2.5}$ are both emitted as primary air pollutants by various mechanical processes (e.g., abrasion, erosion, mixing, or atomization) or combustion processes. They are generated as secondary pollutants through chemical reactions or through the condensation of gaseous pollutants into fine aerosols.

Air pollutant emissions are reported as the rate (by weight or volume) at which specific compounds are emitted into the atmosphere by a source. Typical units for emission rates from a source or source activity are pounds (lb.) per thousand gallons (gal.) of fuel burned, lb. per U.S. ton of material processed, and grams (g) per vehicle-mile (mi.) travelled.

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 [$\mu g/m^3$] of air) or as a volume fraction (e.g., parts per million [ppm] by volume). The ambient air pollutant concentrations measured at a particular location are determined by the pollutant emissions rate, local meteorology, 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.

3.2.1.2 Methods

Section 176(c)(1) of the CAA, commonly known as the General Conformity Rule, requires federal agencies to ensure their actions conform to applicable implementation plans for achieving and maintaining the National Ambient Air Quality Standards for criteria pollutants.

3.2.1.2.1 Application of Regulatory Framework

3.2.1.2.1.1 National Ambient Air Quality Standards

The National Ambient Air Quality Standards for criteria pollutants are set forth in Table 3.2-1. Areas that exceed a standard are designated as "nonattainment" for that pollutant, while areas in compliance with a standard are in "attainment" for that pollutant. An area may be nonattainment for some pollutants and attainment for others simultaneously.

Table 3.2-1: National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide (CO)	9 ppm (10 mg/m^3)	8-hour[1]	None	
	35 ppm (40 mg/m^3)	1-hour[1]	None	
Lead (Pb)	0.15 µg/m^3 [(2)]	Rolling 3-month average	Same as Primary	
Nitrogen Dioxide (NO_2)	53 ppb[3]	Annual (arithmetic mean)	Same as Primary	
	100 ppb	1-hour[4]	None	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour[5]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual[6] (arithmetic mean)	Same as Primary	
	35 µg/m^3	24-hour[7]	Same as Primary	
Ozone (O_3)	0.075 ppm (2008 std)	8-hour[8]	Same as Primary	
	0.08 ppm (1997 std)	8-hour[9]	Same as Primary	
	0.12 ppm	1-hour[10]	Same as Primary	
Sulfur Dioxide (SO_2)	0.03 ppm[11] (1971 std)	Annual (arithmetic mean)	0.5 ppm	3-hour[1]
	0.14 ppm[11] (1971 std)	24-hour[1]		
	75 ppb[12]	1-hour	None	

[1] Not to be exceeded more than once per year.

[2] Final rule signed 15 October 2008. The 1978 lead standard (1.5 micrograms per cubic meter [µg/m^3] as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[3] The official level of the annual NO_2 standard is 0.053 parts per million (ppm), equal to parts per billion (53 ppb), which is shown here for the purpose of clearer comparison to the 1-hour standard.

[4] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective 22 January 2010).

[5] Not to be exceeded more than once per year on average over 3 years.

[6] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

[7] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective 17 December 2006).

[8] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective 27 May 2008).

[9] (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as the U.S. Environmental Protection Agency undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(c) The U.S. Environmental Protection Agency is reconsidering these standards (established in March 2008).

[10] (a) The U.S. Environmental Protection Agency revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$ 1.

[11] The 1971 sulfur dioxide standards remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

[12] Final rule signed 2 June 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

Notes: std = standard, ppm = parts per million, mg/m^3 = milligrams per cubic meter, ppb = parts per billion

Source: U.S. Environmental Protection Agency 2011b, last updated 4 August 2011

States and U.S. territories, through their air quality management agencies, are required to prepare and implement State Implementation Plans for nonattainment areas, which demonstrate how the area will meet the National Ambient Air Quality Standards. Areas that have achieved attainment may be designated as "maintenance areas," subject to maintenance plans showing how the area will continue to meet federal air quality standards. Nonattainment areas for some criteria pollutants are further classified, depending on the severity of their air quality problem, to facilitate their management:

- O_3 – marginal, moderate, serious, severe, and extreme
- CO – moderate and serious
- PM – moderate and serious

The USEPA delegates the regulation of air quality to the state once the state has an approved State Implementation Plan. The CAA also allows states to establish air quality standards more stringent than the National Ambient Air Quality Standards.

The Mariana Islands Training and Testing (MITT) Study Area (Study Area) is mostly offshore of the Territory of Guam and the Commonwealth of the Northern Mariana Islands and some onshore and nearshore areas. Some elements of the Proposed Action would occur onshore and within or over state waters. Most of the Study Area is offshore, beyond territory and commonwealth boundaries where attainment status is unclassified and CAA National Ambient Air Quality Standards do not apply. However, given fluctuations in wind direction, air quality in adjacent onshore areas may be affected by releases of air pollutants from offshore Study Area sources. Therefore, National Ambient Air Quality Standards attainment status of adjacent onshore areas is considered in determining whether appropriate controls on air pollution sources in the adjacent offshore state waters is warranted.

3.2.1.2.1.2 Conformity Analyses in Nonattainment and Maintenance Areas

General Conformity Evaluation

Federal actions are required to conform with the approved State Implementation Plan for those areas of the United States designated as nonattainment or maintenance air quality areas for any criteria pollutant under the CAA (40 Code of Federal Regulations [C.F.R.] §§51 and 93). The purpose of the General Conformity Rule is to demonstrate that the Proposed Action would not cause or contribute to a violation of an air quality standard and that the Proposed Action would not adversely affect the attainment and maintenance of federal ambient air quality standards. A federal action would not conform if it increased the frequency or severity of any existing violations of an air quality standard or delayed the attainment of a standard, required interim emissions reductions, or delayed any other air quality milestone. To ensure that federal activities do not impede local efforts to control air pollution, Section 176(c) of the CAA (42 United States Code [U.S.C.] §7506(c)) prohibits federal agencies from engaging in or approving actions that do not conform to an approved State Implementation Plan. The emissions thresholds that trigger the conformity requirements are called *de minimis* thresholds.

Federal agency compliance with the General Conformity Rule can be demonstrated in several ways. The requirement can be satisfied by a determination that the Proposed Action is not subject to the General Conformity Rule, by a Record of Non-Applicability, or by a Conformity Determination. Compliance is presumed if the net increase in emissions from a federal action would be less than the relevant *de minimis* threshold. If net emissions increases exceed the *de minimis* thresholds, then a formal conformity determination must be prepared. *De minimis* thresholds are shown in Table 3.2-2.

Table 3.2-2: *De Minimis* Thresholds for Conformity Determinations

Pollutant	Nonattainment or Maintenance Area Type	*De Minimis* Threshold (TPY)
Ozone (VOC or NO_x)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NO_x)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
CO, SO_2 and NO_2	All nonattainment & maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
Lead (Pb)	All nonattainment & maintenance	25

Notes: CO = carbon monoxide, NO_X = nitrogen oxides, Pb = lead, PM_{10} = particulate matter under 10 microns, SO_x = sulfur oxides, TPY = tons per year, VOC = volatile organic compounds

Source: U.S. Environmental Protection Agency 2011a

Certain U.S. Department of the Navy training and testing activities take place within specific nonattainment or maintenance areas. These nonattainment and maintenance areas are identified by Air Basin or by Air Quality Control Region (federally designated areas within which communities share common air pollution problems). Coastal waters within 3 nautical miles (nm) of the coast are under the same air quality jurisdiction area as the contiguous land area.

The attainment status of most of the Study Area is unclassified because only areas within Guam and the Commonwealth of the Northern Mariana Islands (CNMI) boundaries are classified; there is no provision in the federal CAA for the classification of waters outside of the boundaries of state waters. As discussed below, however, air quality in adjacent onshore areas may be affected by releases of air pollutants from sources within the offshore areas of the Study Area. The National Ambient Air Quality Standard attainment status of the onshore areas is considered in determining appropriate controls on air pollution sources in onshore areas.

Guam. The Proposed Action includes activities on Guam and its coastal areas. Guam has two areas classified as non-attainment areas for the federal 8-hour SO_2 standard based on monitored and modeled exceedances in the 1970s. These are areas within a 2.2 mi. (3.5-kilometer [km]) radius of the Piti Power Plant and the Tanguisson Power Plant. Since that time, changes have been made to these power generation facilities, including rebuilding the power plants and upgrading their emission controls in the 1990s. Based on these improvements, Guam has submitted a redesignation request to the USEPA for the Piti area showing the area as meeting the ambient standard for SO_2. However, on 3 June 2010, the USEPA issued a new health standard for SO_2, setting the one-hour SO_2 health standard at 75 parts per billion (ppb), a level designed to protect against short-term exposures ranging from 5 minutes to 24 hours. The USEPA revoked the previous 1971 24-hour and annual SO_2 health standards (although the 1971 sulfur dioxide standards remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards

remain in effect until implementation plans to attain or maintain the 2010 standards are approved). The attainment designation based on the new standard was anticipated to occur in 2012 (U.S. Department of the Navy 2010b).

The General Conformity Rule states that a federal action is exempt from the requirements of a full conformity demonstration for those criteria pollutants for which emissions increases are below specific *de minimis* emissions levels. The Proposed Action and its alternatives are required to demonstrate conformity with the currently approved state implementation plan for Guam. In accordance with the General Conformity Rule, the *de minimis* level for SO_2 in the non-attainment areas of Guam is 100 tons per year (TPY) (91 metric TPY).

Commonwealth of the Northern Mariana Islands. The Proposed Action includes activities that occur on islands of the CNMI, specifically, Farallon de Medinilla, Tinian, Saipan and Rota. The USEPA designated the Northern Mariana Islands to be in attainment or unclassified for all criteria pollutants (40 C.F.R. 81.354). Because the CNMI is in attainment of the National Ambient Air Quality Standards, a state implementation plan is not required and the General Conformity Rule does not apply. Except for power generating facilities (e.g., large power plants, hotel generators), there are no significant sources of air emissions within the CNMI (U.S. Department of the Navy 2010a).

3.2.1.2.1.3 Prevention of Significant Deterioration

Class I areas are defined by the CAA as federally owned properties for which air quality-related values are highly prized and for which very little decrease in air quality, including visibility, can be tolerated. The Proposed Action does not include any stationary sources constructed or modified after enactment of the CAA regulations, so the Prevention of Significant Deterioration Class I requirements do not apply.

On 13 May 2010, the USEPA issued a final rule that established a common sense approach to addressing greenhouse gas emissions from stationary sources under the CAA permitting programs (U.S. Environmental Protection Agency 2010a). This final rule sets thresholds for greenhouse gas emissions that define when permits under the New Source Review Prevention of Significant Deterioration and Title V Operating Permit programs are required for new and existing industrial facilities. The Navy aircraft, vessel, system, and munitions training and testing included in the Proposed Action do not involve any new or existing industrial facilities or stationary sources subject to the greenhouse gas tailoring rule.

3.2.1.2.2 Approach to Analysis

The air quality impact evaluation requires two separate analyses: (1) impacts of air pollutants emitted by military training and testing on land and in U.S. territorial seas (i.e., within 12 nm of the coast) are assessed under the National Environmental Policy Act (NEPA), and (2) impacts of air pollutants emitted by military training and testing activities outside of U.S. territorial seas are evaluated under Executive Order (EO) 12114. State waters are within the jurisdiction of the respective State and, because each state has a distinct State Implementation Plan and supplementary state and local regulations, the air quality evaluation separately addresses those activities that emit air pollutants within each state's jurisdiction. Portions of the Study Area that lie more than 3 nm, but less than 12 nm, offshore are under federal jurisdiction.

The analysis of health-based air quality impacts under NEPA includes estimates of criteria air pollutants for all training and testing activities for which aircraft, missiles, or targets operate at or below 3,000 feet (ft.) (914 meters [m]) above ground level or which involve vessels in U.S. territorial seas. The analysis of

health-based air quality impacts under EO 12114 includes emissions estimates of only those training and testing activities in which aircraft, missiles, or targets operate at or below 3,000 ft. (914 m) above ground level or that involve vessels outside of U.S. territorial seas. Air pollutants emitted more than 3,000 ft. (914 m) above ground level are considered to be above the atmospheric inversion layer and, therefore, do not affect ground-level air quality (U.S. Environmental Protection Agency 1992). These emissions thus do not affect the concentrations of air pollutants in the lower atmosphere, measured at ground-level monitoring stations, upon which federal, state, and local regulatory decisions are based. For the analysis of the impacts on global climate change, however, all emissions of greenhouse gases from aircraft and vessels participating in training and testing activities, as well as targets and ordnance expended, are included regardless of altitude (Chapter 4, Cumulative Impacts).

Criteria pollutants are generated by the combustion of fuel by surface vessels, by fixed-wing and rotary-wing aircraft, and ground-based vehicles and equipment. They also are generated by the combustion of explosives and propellants in various types of munitions. Propellants used in small-, medium-, and large-caliber projectiles generate criteria pollutants when detonated. Non-explosive practice munitions contain spotting charges and propellants that generate criteria pollutants when they function. Powered targets require fuel, generating criteria pollutants during their operation, and towed targets generate criteria pollutants secondarily because another aircraft or vessel is required to provide power. Targets may generate criteria pollutants if 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 criteria pollutants. Countermeasure flares, decelerator/parachute flares, and smoke floats are designed to burn for a prescribed period, emitting criteria pollutants in the process.

The air quality analysis also includes estimating the amounts of hazardous air pollutants emitted by the proposed activities and assessing their potential impacts on air quality. Trace amounts of hazardous air pollutants would be emitted by combustion sources and use of ordnance. Hazardous air pollutants, such as rocket motor exhaust and unspent missile fuel vapors, may be emitted during missile and target use. Hazardous air pollutants are generated, in addition to criteria pollutants, by combustion of fuels, explosives, propellants, and the materials of which targets, munitions, and other training and testing materials are constructed (e.g., plastic, paint, wood). Fugitive volatile and semi-volatile petroleum compounds also may be emitted whenever mechanical devices are used. These emissions are typically one or more orders of magnitude smaller than concurrent emissions of criteria pollutants, and only become a concern when large amounts of fuel, explosives, or other materials are consumed during a single activity or in one location.

Emissions of hazardous air pollutants are intermittent and dispersed over a vast ocean area. Because only small quantities of hazardous air pollutants are emitted into the lower atmosphere, which is well mixed over the ocean, the potential for exposure is very low and the risk presented by the emissions is similarly very low. The primary emissions from many munition types are CO_2, CO, and particulate matter; hazardous air pollutants are emitted at low levels (U.S. Environmental Protection Agency 2008). A quantitative evaluation of hazardous air pollutant emissions is thus not warranted and was not conducted.

Electronic warfare countermeasures generate emissions of chaff, a form of particulate not regulated under the federal CAA as a criteria pollutant (virtually all radio frequency chaff is 10 to 100 times larger than particulate matter under PM_{10} and $PM_{2.5}$ [Spargo 1999]). The types of training and testing that produce these other emissions may take place throughout the Study Area but occur primarily within special use airspace. Chaff emissions during training and testing primarily occur 3 nm or more from

shore and at altitudes over 3,000 ft. (914 m) (above the mixing layer). Chaff released over the ocean would disperse in the atmosphere and then settle onto the ocean surface. The air quality impacts of chaff were evaluated by the Air Force in *Environmental Effects of Self-Protection Chaff and Flares* (U.S. Air Force 1997). The study concluded that most chaff fibers maintain their integrity after ejection. Although some fibers are likely to fracture during ejection, it appears this fracturing does not release particulate matter. Tests indicated that the explosive charge in the impulse cartridge results in minimal releases of particulate matter. A later study at Naval Air Station Fallon found that the release of 50,000 cartridges of chaff per year over 10,000 mi.^{2} (25,899.9 km^2) would result in an annual average PM_{10} or $PM_{2.5}$ concentration of 0.018 µg/m^3, far below the then National Ambient Air Quality Standard of 50 µg/m^3 for PM_{10} and 15 µg/m^3 for $PM_{2.5}$.[1] Therefore, chaff is not further evaluated as an air quality stressor in this EIS/OEIS.

The NEPA analysis includes a CAA General Conformity Analysis to support a determination pursuant to the General Conformity Rule (40 C.F.R. Part 93B). This analysis focuses on training and testing activities that could impact the nonattainment area within the region of influence. The Study Area overlies the Guam Air Quality Control Region. To evaluate the conformity of the Proposed Action with the State Implementation Plan elements of Guam, air pollutant emissions generated within the nonattainment areas of Guam are estimated based on the proposed training and testing activities that would be conducted in the Guam nonattainment areas. The CAA Conformity Applicability Analysis addresses the applicability of the General Conformity Rule. Air pollutant emissions outside U.S. territorial seas are estimated and their potential impacts on air quality are assessed through the EO 12114 compliance analysis. Emissions outside U.S. territorial seas are calculated in the same manner as emissions over territorial waters. The General Conformity Rule does not apply to activities outside of U.S. territorial seas because the CAA does not apply to actions outside of the United States.

Data for the air quality analysis are based, wherever possible, on information from military subject matter experts and established training and testing requirements. These data were used to estimate the numbers and types of aircraft, surface ships and vessels, submarines, munitions and ground-based vehicles and equipment (i.e., potential sources of air emissions) that would be involved in training and testing activities under each alternative. Emissions sources and the approach used to estimate emissions under the No Action Alternative, Alternative 1, and Alternative 2 are presented herein.

3.2.1.2.3 Emissions Estimates

3.2.1.2.3.1 Aircraft Activities

To estimate aircraft emissions, the operating modes (e.g., “cruise” mode), number of hours of operation, and types of engine for each type of aircraft were evaluated. For estimating purposes, training and testing aircraft flights are assumed to originate offshore from aircraft carriers or other Navy vessels outfitted with flight decks and from North Field at Andersen Air Force Base. With the exception of helicopters, all aircraft are assumed to travel to and from training ranges at or above 3,000 ft. (914 m) above mean sea level and, therefore, their transits to and from the ranges do not affect surface air quality. Air combat maneuvers and air-to-air missile exercises are primarily conducted at altitudes well in excess of 3,000 ft. (914 m) above ground level and, therefore, are not included in the estimated emissions of criteria pollutants. Activities or portions of those training or testing activities occurring below 3,000 ft. (914 m) are included in emissions estimates. Examples of activities typically occurring below 3,000 ft. (914 m) include those involving helicopter platforms such as mine warfare, anti-surface warfare, and anti-submarine warfare training and testing activities.

[1] The current standard for PM_{10} is 150 µg/m^3 over a 24-hour average time (See Table 3.2-1).

The types of aircraft used and the numbers of sorties flown under the No Action Alternative are those analyzed in the Mariana Islands Range Complex EIS/OEIS under the preferred alternative, which are incorporated in this EIS/OEIS by reference. For Alternatives 1 and 2, estimates of future aircraft sorties are based on evolutionary changes in the military's force structure and mission assignments. Where there are no major changes in types of aircraft, future activity levels are estimated from the distribution of baseline activities.

Time on range (activity duration) was based on the operational limit of the aircraft. The same time on range for each aircraft activity under the No Action Alternative was used in Alternatives 1 and 2. With the exception of helicopters, estimated altitudes of activities for all aircraft were assumed to be above 3,000 ft. (914 m) except during landing and takeoff. Testing activities are similar to training activities, and therefore similar assumptions were made for such activities in terms of aircraft type, altitude, and flight duration.

Air pollutant emissions were estimated based on the Navy's Aircraft Environmental Support Office Memorandum Reports for individual aircraft categories (Aircraft Emission Estimates: Mission Operations). For aircraft for which Aircraft Environmental Support Office emission factors were not available, emission factors were obtained from other published sources.

The emissions calculations for each alternative conservatively assume that each aircraft activity listed in Tables 2.8-1 to 2.8-4, is separately conducted. In practice, a testing activity may be conducted during a training flight. Two or more training activities also may be conducted during one flight (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). Using conservative assumptions may produce elevated aircraft emissions estimates but accounts for the possibility (however remote) that each aircraft training and testing activity is separately conducted.

3.2.1.2.3.2 Surface Ship Activities

Marine vessel traffic in the Study Area includes military ship and boat traffic, unmanned surface vessels, and range support vessels providing services for military training and testing activities. Non-military commercial vessels and recreational vessels also are regularly present. These commercial vessels are not evaluated in the air quality analysis because they are not part of the Proposed Action. The methods for estimating marine vessel emissions involve evaluating the type of activity, the number of hours of operation, the type of propulsion, and the type of onboard generator for each vessel type.

The types of surface ships and numbers of activities for the No Action Alternative are derived from range records and Navy subject matter experts regarding vessel participant data. For Alternatives 1 and 2, estimates of future ship activities are based on anticipated evolutionary changes in the Navy's force structure and mission assignments. Where there are no major changes in types of ships, estimates of future activities are based on the historical distribution of ship use. Navy aircraft carriers and submarines are nuclear-powered and have no air pollutant emissions associated with propulsion.

For surface ships, the durations of activities were estimated by taking an average over the total number of activities for each type of training and testing. Emissions for baseline activities and for future activities were estimated based on discussions with exercise participants. In addition, information provided by subject-matter experts was used to develop a breakdown of time spent at each operational mode (i.e., power level) used during activities in which marine vessels participated. Several testing activities are

similar to training activities, and therefore similar assumptions were made for such activities in terms of vessel type, power level, and activity duration.

Emission factors for marine vessels are obtained from the database developed for Naval Sea Systems Command by John J. McMullen Associates, Inc. (2001). Emission factors were provided for each marine vessel type and power level. The resulting calculations provided information on the time spent at each power level in each part of the Study Area, emission factors for that power level (in pounds of pollutant per hour), and total emissions for each marine vessel for each operational type and mode.

The pollutants for which calculations were made include exhaust total hydrocarbons, CO, NO_x, PM, CO_2, and SO_2. For non-road engines, all particulate matter emissions are assumed to be smaller than PM_{10}, and 92 percent of the particulate matter from gasoline and diesel-fueled engines is assumed to be smaller than $PM_{2.5}$ (U.S. Environmental Protection Agency 2002). For gaseous-fueled engines (liquefied petroleum gas/compressed natural gas), 100 percent of the particulate matter emissions are assumed to be smaller than $PM_{2.5}$ (U.S. Environmental Protection Agency 2002).

The emissions calculations for each alternative conservatively assume that each vessel activity listed in Chapter 2, Tables 2.8-1 to 2.8-4 is separately conducted and separately produces vessel emissions. In practice, one or more testing activities may take advantage of an opportunity to travel at sea aboard and test from a vessel conducting a related or unrelated training activity. It is also probable that two or more training activities may be conducted during one training vessel movement (e.g., a ship may conduct large-, medium-, and small-caliber surface-to-surface gunnery exercises during one vessel movement). Furthermore, multiple unit-level training activities may be conducted during a larger composite training unit exercise. Using conservative assumptions may produce elevated vessel emissions estimates but accounts for the possibility (however remote) that each training and testing activity is separately conducted.

3.2.1.2.3.3 Submarine Activities

No U.S. submarines burn fossil fuel under normal operating conditions (they are nuclear-powered); therefore, no air pollutants are emitted during submarine training or testing activities except those non-nuclear submarines owned by participating nations in joint exercises during training activities in the Study Area. Activities of foreign participants are not covered in this air quality analysis.

3.2.1.2.3.4 Naval Gunfire, Missiles, Bombs, Other Munitions, and Military Expended Materials

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 ordnance during use, the numbers and types of munitions used during training or testing activities are first totaled. Then, generally accepted emissions factors (AP-42, Compilation of Air Pollutant Emission Factors, Chapter 15: Ordnance Detonation [U.S. Environmental Protection Agency 1995]) for criteria pollutants are applied to the total amounts. Finally, the total amounts of air pollutants emitted by each munition type are summed to produce total amounts of each criteria pollutant under each alternative.

3.2.1.2.4 Sensitive Receptors

Identification of sensitive receptors is part of describing the existing air quality environment. Sensitive receptors are individuals in residential areas, schools, parks, hospitals, and other sites for whom there is a reasonable expectation of continuous human exposure during periods of peak ambient air pollutant concentrations. In the oceanic portions of the Study Area, crews of vessels and recreational users of the western Pacific Ocean and the Philippine Sea may encounter air pollutants generated by the Proposed

Action. Few such individuals are typically present, however, and the durations of their exposure to substantial concentrations of these pollutants is limited because the areas are cleared of nonparticipants before activities commence. These potential receptors are not considered sensitive.

3.2.1.3 Climate Change

Greenhouse gases are compounds that contribute to the greenhouse effect—a natural phenomenon in which gases trap heat in the lowest layer of the earth's atmosphere (surface-troposphere system), causing heating (radiative forcing) at the surface of the earth. The primary long-lived greenhouse gases directly emitted by human activities are CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF_6). CO_2, CH_4, and N_2O occur naturally in the atmosphere. However, their concentrations increased from the pre-industrial era (1750) to 2007–2008: CO_2 (38 percent), CH_4 (149 percent), and N_2O (23 percent) (U.S. Environmental Protection Agency 2009b). These gases influence global climate by trapping heat in the atmosphere that would otherwise escape to space. The heating effect of these gases is considered the probable cause of the global warming observed over the last 50 years (U.S. Environmental Protection Agency 2009b, c). Climate change can affect many aspects of the environment. Not all impacts of greenhouse gases are related to climate. For example, elevated concentrations of CO_2 can lead to ocean acidification and stimulate terrestrial plant growth, and CH_4 emissions can contribute to higher O_3 levels.

The administrator of the USEPA determined that six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations. The USEPA specifically identified CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and SF_6 as greenhouse gases (U.S. Environmental Protection Agency 2009c; 74 Federal Register 66496, 15 December 2009).

To estimate global warming potential, the United States quantifies greenhouse gas emissions using the 100-year timeframe values established in the Intergovernmental Panel on Climate Change Second Assessment Report (Intergovernmental Panel on Climate Change 1995), in accordance with United Nations Framework Convention on Climate Change (United Nations Framework Convention on Climate Change 2004) reporting procedures. All global warming potentials are expressed relative to a reference gas, CO_2, which is assigned a global warming potential equal to 1. The five other greenhouse gases have a greater global warming potential than CO_2, ranging from 21 for CH_4, 310 for N_2O, 140 to 6,300 for hydrofluorocarbons, 6,500 to 9,200 for perfluorocarbons, and up to 23,900 for SF_6. To estimate the CO_2 equivalency of a non-CO_2 greenhouse gas, the appropriate global warming potential of that gas is multiplied by the amount of the gas emitted. All six greenhouse gases are multiplied by their global warming potential and the results are added to calculate the total equivalent emissions of CO_2 (CO_2e). The dominant greenhouse gas emitted is CO_2, mostly from fossil fuel combustion (85.4 percent) (U.S. Environmental Protection Agency 2009b, c). Weighted by global warming potential, CH_4 is the second largest component of emissions, followed by N_2O. Global warming potential-weighted emissions are presented in terms of equivalent emissions of CO_2, using units of teragrams (1 million metric tons or 1 billion kilograms [Tg]) of carbon dioxide equivalents (Tg CO_2 Eq). The Proposed Action is anticipated to release greenhouse gases to the atmosphere. These emissions are quantified for the proposed Navy training and testing in the Study Area, and estimates are presented in Chapter 4 (Cumulative Impacts).

The potential effects of proposed greenhouse gas emissions are by nature global; individual sources of greenhouse gas emissions are not large enough to have any noticeable effect on climate change but may have cumulative impacts. Therefore, the impact of proposed greenhouse gas emissions on climate change is discussed in the context of cumulative impacts in Chapter 4 (Cumulative Impacts).

3.2.1.4 Other Compliance Considerations, Requirements and Practices

3.2.1.4.1 Executive Order 12088

Executive Order 12088, *Federal Compliance with Pollution Control Standards*, requires each federal agency to comply with applicable pollution control standards, defined as, "the same substantive, procedural, and other requirements that would apply to a private person." The EO further requires federal agencies to cooperate with USEPA, state, and local environmental regulatory officials.

3.2.1.4.2 Chief of Naval Operations Instruction 5090.1

The Navy developed Chief of Naval Operations Instruction (OPNAVINST) 5090.1 series, which contains guidance for environmental evaluations. Chapter 7 and Appendix F of this series contain guidance for air quality analysis and general conformity determinations. The analysis in this EIS/OEIS was performed in compliance with this instruction.

3.2.1.4.3 Current Requirements and Practices

Equipment used by military units in the Study Area, including ships and other marine vessels, aircraft, and other equipment, are properly maintained and fueled in accordance with applicable military requirements. Operating equipment meets federal and state emission standards, where applicable. For example, in accordance with the OPNAVINST 5090.1 series, Chapter 7, Navy commands shall comply with Navy and regulatory requirements for composition of fuels used in all motor vehicles, equipment, and vessels. To prevent misfueling, installations shall enforce appropriate controls to ensure that any fuel that does not meet low-sulfur requirements is not dispensed to commercial motor vehicles, equipment, or vessels not covered under a national security exemption.

The USEPA's Region 9 Air Division manages, implements, and enforces programs covering indoor and outdoor air quality, radiation, control of air pollution from stationary and mobile sources, stratospheric O_3 protection, and other air quality related programs for the Pacific Southwest. Region 9 also has an active and direct role over islands west and south of Hawaii, including the U.S. territories of Guam and American Samoa, the CNMI, and other unincorporated U.S. Pacific possessions.

Guam. Guam has an approved state implementation plan which was developed to allow the Territory to achieve attainment of the National Ambient Air Quality Standard for sulfur oxides in an area where the standard is exceeded (area where power production facilities [Tanguisson and Piti power plants] burning high sulfur content fuel oil are located). In lieu of the USEPA's Title V operating permit program, Guam has an approved alternate operating permit program (40 C.F.R. Part 69, Subpart A – Guam).

The Air and Land Programs Division of the Guam Environmental Protection Agency administers the air pollution control program in Guam by implementing and enforcing Guam's Air Pollution Control Standards and Regulations. The Air Pollution Control Act of Guam or Public Law 10-74 was promulgated and codified under Chapter 49, Title 10 of the Guam Code Annotated (GCA) to support requirements of the CAA.

The CAA Amendments of 1990 established a new standard of 500 ppm maximum sulfur content and a minimum cetane index (calculated based on the fuel's density and distillation range) of 40 for on-highway diesel, which took effect in October 1993. Guam and the CNMI, upon submitting petitions requesting exemption from the sulfur content requirement, were granted exemptions. The 500 ppm standard was reduced further to 15 ppm in 2006 and both Guam and the CNMI were exempt from the new standard. However, in August 2010, Senate Bill 414-30 was passed by the Guam legislature that

requires that "all diesel imported to Guam for the purpose of sale and distribution shall meet the USEPA standards for ultra low sulfur diesel" (I' Minatrenta Na Liheslaturan Guahan 2010), effective 1 January 2011. In effect all diesel on Guam contains no more than 15 ppm sulfur.

Commonwealth of the Northern Mariana Islands. The CNMI Department of Environmental Quality is the primary environmental regulatory agency in the Commonwealth. It is responsible for developing, implementing, and enforcing programs and regulations designed to protect human health and the environment. The CNMI Department of Environmental Quality's air pollution control regulations can be found in the Federal Register (FR) (52 FR 43574).

The CNMI Department of Environmental Quality is responsible for air quality within the Commonwealth. Air quality is not monitored in the Commonwealth, except for SO_2 related to volcanic activity from Anatahan, which is monitored by the CNMI Emergency Management Office (U.S. Department of the Navy 2010b).

3.2.2 AFFECTED ENVIRONMENT

3.2.2.1 Region of Influence

The region of influence for air quality is a function of the type of pollutant, emission rates of the pollutant source, proximity to other emission sources, and local and regional meteorology. For inert pollutants (all pollutants other than O_3 and its precursors), the region of influence is generally limited to a few miles downwind from the source. For a photochemical pollutant such as O_3, however, the region of influence may extend much farther downwind. O_3 is a secondary pollutant formed in the atmosphere by photochemical reactions of previously emitted pollutants, or precursors (volatile organic compounds and NO_X). The maximum effects of precursors on O_3 concentrations tend to occur several hours after the time of emission during periods of high solar load, and may occur many miles from the source. O_3 and O_3 precursors transported from other regions can also combine with local emissions to produce high local O_3 concentrations. Therefore, the region of influence for air quality includes the island air basins within the Study Area as well as adjoining land areas several miles inland, which may from time to time be downwind from emission sources associated with the Proposed Action.

3.2.2.2 Climate of the Study Area

The climate of the Study Area influences air quality. The climate of the Pacific Ocean and adjacent land areas is influenced by the temperatures of the surface waters and water currents as well as by wind blowing across the water. Offshore climates are moderate, and seldom have extreme seasonal variations because the ocean is slow to change temperature. Ocean currents influence climate by moving warm and cold water between regions. Adjacent land areas are affected by the wind that is cooled or warmed when blowing over these currents. In addition to its influence on temperature, the wind moves evaporated moisture from the ocean to adjacent land areas and is a major source of rainfall.

Atmospheric stability and mixing height provide a measure of the amount of vertical mixing of pollutants. Over water, the atmosphere tends to be neutral to slightly unstable because there is usually a positive heat and moisture flux. Over land, the atmospheric stability is more variable, being unstable during the daytime, especially in summer due to rapid surface heating, and stable at night, especially under clear conditions in winter. The mixing height over water typically ranges between 1,640 and 3,281 ft. (500 and 1,000 m), with a slight diurnal variation (U.S. Environmental Protection Agency 1972). The air quality analysis presented in this EIS/OEIS assumes that 3,000 ft. (914 m) is the typical maximum

afternoon mixing height, and thus air pollutants emitted above this altitude do not affect ground-level air pollutant concentrations.

The climate in the Mariana Islands is characterized as tropical marine where the weather is warm and humid, and seasonal temperature variation is low. The average temperature in the Mariana Islands is 81 degrees Fahrenheit (°F) (27.2 degrees Celsius [°C]) (ClimateTemp.Info 2011). Daily temperatures on Guam average a low of 72°F (22°C) and a high of 86°F (30°C) (National Weather Service 2011). The average maximum temperature is 88°F (31°C) occurring in April, May, and June. The average minimum temperature is 73°F (23°C) occurring in February.

The average wind speed from December to May is 8–12 miles per hour (mph) (13–19 kilometers per hour [kph]), and from June to November is 4–7 mph (6–11 kph) (ClimateTemp.Info 2011).

There are two seasons, the dry season (January–June) and the wet season (July–December). During the dry season, prevailing winds are from the east and northeast. The dry season provides the most pleasant weather, with slightly lower humidity and a monthly rainfall average of just 4.5 inches (114 millimeters) (Joint Typhoon Warning Center 2010; National Weather Service 2011). The driest month is April and the wettest month is August.

Guam and the CNMI lie directly along the typhoon track, with typhoons most commonly occurring from August to December (Joint Typhoon Warning Center 2010; National Weather Service 2011).

3.2.2.3 Regional Emissions

Most stationary air pollutant sources in the Study Area are located on Guam and Saipan, with some minor contributions from stationary sources on Rota and Tinian. The largest point sources of major air pollutants in the Mariana Islands are power-generating stations, although Andersen Air Force Base on Guam is considered a major stationary source that requires a Title V operating permit (U.S. Department of the Navy 2010a, b).

The small number of major sources, dispersed population centers, and generally good ventilation from daily trade winds result in good to excellent air quality in the Study Area. Volcanic organic gases from volcanic eruptions from several island stratovolcanos in the area, the most active of which is Anatahan, are a natural source of sulfur dioxide and other air pollutants in the Study Area.

3.2.2.4 Existing Air Quality

Air quality in offshore ocean areas is generally better than the air quality of adjacent onshore areas because there are few or no large sources of criteria pollutants offshore. Much of the air pollutants found in offshore areas are transported there from adjacent land areas by offshore winds, so concentrations of criteria pollutants generally decrease with increasing distance from land. No criteria pollutant monitoring stations are located in offshore areas, so air quality in the offshore areas of the Study Area are inferred from the air quality on Guam and the CNMI.

In general terms, the air quality on Guam and the CNMI is considered very good (i.e., Guam and the CNMI have been designated in attainment or unclassified for all criteria pollutants, with the exception of SO_2 around the Tanguisson and Piti power facilities on Guam). This is reflective of the pollutant concentrations, the size and topography of the Mariana Islands, and the prevailing meteorological conditions. The nearly constant easterly trade winds, which average about 4–12 mph (6–19 kph), are

dominant throughout the year and prevent the occurrence of inversion layers and the build-up of pollutants.

Recent ambient air quality data are not available for the islands of Guam and the CNMI. Because of the lack of ambient air quality data, the existing conditions on the islands in the Study Area cannot be evaluated by a direct comparison of the ambient pollutant concentration levels with the National Ambient Air Quality Standards (refer to Section 3.2.1.2.1.1, National Ambient Air Quality Standards).

3.2.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates how and to what degree the activities described in Chapter 2 (Description of the Proposed Action and Alternatives) could impact air quality within the Study Area. Tables 2.8-1 through 2.8-4 present the baseline and proposed training and testing activity locations for each alternative (including number of activities and ordnance expended). The air quality stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to air quality in the Study Area are analyzed below and include the following:

- Criteria pollutants
- Hazardous air pollutants

In this analysis, criteria air pollutant emissions were estimated for vessels, aircraft, ordnance and ground-based vehicles and equipment. For each alternative, emissions estimates were developed and totaled for the Study Area. Hazardous air pollutants are analyzed qualitatively in relation to the prevalence of the sources emitting hazardous air pollutants during training and testing activities.

3.2.3.1 Criteria Pollutants

The potential impacts of criteria pollutants are evaluated by first estimating the emissions from training and testing activities in the Study Area for each alternative. These estimates are then used to determine the potential impact of the emissions on the attainment status of the adjacent air quality control region. Emissions of criteria pollutants may affect human health directly by degrading local or regional air quality or indirectly by their impacts on the environment. Air pollutant emissions may also have a regulatory effect separate from their physical effect, if additional air pollutant emissions change the attainment status of an air quality control region.

The estimates of criteria pollutant emissions for each alternative are organized by activity (i.e., either training or testing).Total air pollutant emissions for Navy training and testing activities in the Study Area under each alternative are also estimated.

3.2.3.1.1 No Action Alternative

3.2.3.1.1.1 Training Activities

Table 3.2-3 lists training-related criteria pollutant and precursor emissions in the Study Area. Calculation details are presented in spreadsheets in Appendix D (Air Quality Calculations and Record of Non-Applicability). Totals include emissions from aircraft, vessels, ordnance, and ground-based vehicles and equipment that are anticipated to be involved in training activities.

Table 3.2-3: Annual Criteria Pollutant Emissions from Training under the No Action Alternative

Source	Air Pollutant Emissions (TPY)					
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$
Aircraft	124	120	17	7	57	52
Vessels	218	273	88	330	60	54
Ordnance	93	2	0	0	3	3
Other Equipment	39	98	12	0	40	36
Total	**474**	**493**	**117**	**337**	**160**	**145**

Notes: TPY = tons per year, CO = carbon monoxide, NO_X = nitrogen oxides, VOC = volatile organic compounds, SO_x= sulfur oxides, PM_{10} = particulate matter <10 microns, $PM_{2.5}$ = particulate matter under 2.5 microns

Under the No Action Alternative, the annual numbers of military training activities in the Study Area would remain at baseline (existing) levels. The criteria pollutants that would be emitted in the greatest quantities by aircraft are typically CO, NO_x, and PM (PM_{10} and $PM_{2.5}$). These emissions are associated with aircraft in a variety of training activities, including anti-air warfare, electronic warfare, and mine warfare. The air pollutants emitted in the greatest quantities from surface vessels are typically NO_x, CO, and SO_x. These emissions are associated with vessels in a variety of training activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutants emitted in the greatest quantities by ordnance are CO and PM (PM_{10} and $PM_{2.5}$), which would be emitted under the No Action Alternative by a variety of ordnance, including bombs, rockets, missiles, smokes, flares, and gun rounds. Other equipment, which include assault vehicles, high mobility multipurpose wheeled vehicles, trucks, generators, water purification units, bulldozers, forklifts, cranes, and others, are used on land and also contribute to emissions from training.

While pollutants emitted in the Study Area include emissions generated on land and near shore (within 3 nm of the shoreline), emissions would also be generated in areas more than 3 nm offshore. Natural mixing would substantially disperse the majority of the pollutants before they reach land and the boundaries of the adjacent air quality control region or air basin. The contributions of air pollutants generated from the Proposed Action to onshore and near shore air quality would have no substantial effect and are unlikely to measurably add to existing onshore and near shore pollutant concentrations because (1) the pollutants are emitted over a large area (i.e., the Study Area is an area source), (2) the distances the offshore pollutants would be transported are often large, and (3) the pollutants are substantially dispersed during transport.

3.2.3.1.1.2 Testing Activities

Under the No Action Alternative, the Navy would continue conducting deep water sound propagation and temperature-sound velocity profile studies of the water column in the Study Area (refer to Table 2.4-4 for a complete description). Active data collection by research vessels is scheduled during May and July of 2018 and passive data collection by remotely sensing gliders later in the year. The final phases of the experiment will be completed during March through May 2019. Since this is a nonrecurring activity with emission sources limited to research vessels over a short duration and that would occur in an isolated area of the Study Area, associated air pollutant emissions from this testing activity would be minimal and are unlikely to have an impact on the air quality of the Study Area. No further consideration of this testing activity's impact on air quality is warranted under the other alternatives.

3.2.3.1.1.3 Criteria Pollutant Emissions in Nonattainment and Maintenance Areas

The nonattainment areas in the Study Area are areas within 2.2 mi. (3.5 km) of the Piti and Tanguisson Power Plants in Guam. These areas have been designated as nonattainment areas for SO_2 only; therefore, this analysis will be limited to SO_2 emissions. There are no nonattainment and maintenance areas in the CNMI for any criteria pollutants.

Training Activities

Under the No Action Alternative, SO_2 emissions from training in the nonattainment areas were estimated at 172 tons per year (based on a worst case assumption that all training activities that *may* take place in the nonattainment areas would take place in the nonattainment areas (refer to calculation details presented in Appendix D, Air Quality Calculations and Record of Non-Applicability). However, these training activities can occur in other areas outside of the nonattainment areas, such as in the CNMI, Andersen Air Force Base, Naval Base Guam Munitions Site, Naval Base Guam Telecommunications Site, and many other training locations in the Study Area (see Figures 2.1-1 through 2.1-12 for training and testing areas within the MITT Study Area). In addition, all ships and aircraft associated with a training activity were fully accounted for, even though they may operate within the nonattainment area for a very limited amount of time or may not operate there at all (e.g., outside of the 2.2 mi. [3.5 km] distance from the center of the nonattainment area, at altitudes above 3,000 ft. [914 m]).

Testing Activities

Under the No Action Alternative, there are no testing activities that occur in the nonattainment areas in the Study Area.

3.2.3.1.1.4 General Conformity Threshold Determinations

The No Action Alternative is exempt from the federal General Conformity Rule because training and testing activities would not increase criteria pollutant emissions above baseline levels in the nonattainment areas of Guam.

3.2.3.1.1.5 Summary – No Action Alternative

Criteria air pollutant emissions under the No Action Alternative are summarized in Table 3.2-4. While criteria air pollutants emitted within the territorial waters of the Study Area may be transported ashore, they would not affect the attainment status of coastal air quality control regions. The amounts of air pollutants emitted in the Study Area and subsequently transported ashore would have no substantial effect on air quality because (1) the pollutants are emitted over large areas (i.e., the Study Area is an area source), (2) the distances the air pollutants would be transported are often large, and (3) the pollutants are substantially dispersed during transport. The criteria air pollutants emitted over non-territorial waters within the Study Area would be dispersed over vast areas of open ocean and thus would not cause significant harm to environmental resources in those areas.

Table 3.2-4: Estimated Annual Criteria Air Pollutant Emissions in MITT Study Area, No Action Alternative

Source	Emissions by Air Pollutant (TPY)						
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Training Activities	474	493	117	337	160	145	1,726
Testing Activities	0	0	0	0	0	0	0
Total MITT Study Area	**474**	**493**	**117**	**337**	**160**	**145**	**1,726**

Notes: TPY = tons per year, CO = carbon monoxide, NO_X = nitrogen oxides, VOC = volatile organic compounds, SO_x= sulfur oxides, PM_{10} = particulate matter <10 microns, $PM_{2.5}$ = particulate matter under 2.5 microns

3.2.3.1.2 Alternative 1

3.2.3.1.2.1 Training Activities

Under Alternative 1, the annual numbers of various military training activities in the Study Area would increase according to Table 2.8-1. Therefore, emissions rates for criteria pollutants also would increase relative to emissions under the No Action Alternative. The total amounts of criteria pollutants emitted by military aircraft, vessels, ordnance and ground-based vehicles and equipment during training activities in the Study Area under Alternative 1 are shown in Table 3.2-5. Calculation details are presented in spreadsheets in Appendix D (Air Quality Calculations and Record of Non-Applicability). The percent increases in criteria pollutants range from 79 percent (for VOC) to almost 200 percent (for NO_x). Air pollutants from training activities under Alternative 1 would not have a measurable impact on air quality in coastal waters or on adjacent land areas because of the distances from land at which about half of the pollutants are emitted and the generally strong ventilation resulting from regional meteorological conditions. About 47 percent of training emissions would be produced beyond 3 nm (also includes emissions beyond 12 nm) from shore. About 29 percent of emissions are generated beyond 12 nm from shore.

Table 3.2-5: Annual Criteria Pollutant Emissions from Training under Alternative 1

Source	Air Pollutant Emissions (TPY)					
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$
Aircraft	318	699	44	32	280	252
Vessels	453	611	151	645	122	108
Ordnance	233	4	0	0	6	6
Other Equipment	48	122	15	0	51	46
Total	**1,052**	**1,436**	**210**	**677**	**459**	**412**

Notes: TPY = tons per year, CO = carbon monoxide, NO_X = nitrogen oxides, VOC = volatile organic compounds, SO_x = sulfur oxides, PM_{10} = particulate matter <10 microns, $PM_{2.5}$ = particulate matter under 2.5 microns

3.2.3.1.2.2 Testing Activities

Sources of emissions from testing activities in the Study Area are from Navy aircraft and vessels as listed in Tables 2.8-2 to 2.8-3. Naval Air Systems Command testing activity consists of anti-submarine warfare tracking test using maritime patrol aircraft and anti-surface warfare missile tests. Naval Sea Systems Command testing activities involve mostly ship-related activities such as ship signature testing, countermeasure acoustic system testing, at-sea sonar testing and mission packages (anti-submarine warfare, anti-surface warfare, and mine countermeasure) testing. Table 3.2-6 presents emissions from Navy testing activities. Calculation details are presented in spreadsheets in Appendix D (Air Quality Calculations and Record of Non-Applicability). Air pollutants from testing activities under Alternative 1 would not have a measurable impact on air quality in coastal waters or on adjacent land areas because a majority of the emissions are generated beyond 3 nm from shore, and the generally strong ventilation in the area resulting from regional meteorological conditions would quickly disperse the emissions. A percent increase for criteria emissions from testing activities under Alternative 1 cannot be evaluated because, with the exception of the existing testing conducted by the Office of Naval Laboratory (which was not evaluated because of its distant location from the potential impact areas), these proposed testing activities are not currently conducted under the No Action Alternative.

Table 3.2-6: Annual Criteria Pollutant Emissions from Testing under Alternative 1

Source	Air Pollutant Emissions (TPY)					
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$
Aircraft	5	19	1	1	9	8
Vessels	260	167	24	35	10	8
Ordnance	0	0	0	0	1	1
Other Equipment	0	0	0	0	0	0
Total	**265**	**186**	**25**	**36**	**20**	**17**

Notes: TPY = tons per year, CO = carbon monoxide, NO_X = nitrogen oxides, ROG/HC = reactive organic gases/hydrocarbons, SO_x = sulfur oxides, PM_{10} = particulate matter <10 microns, $PM_{2.5}$ = particulate matter under 2.5 microns; *emissions estimates are preliminary*

3.2.3.1.2.3 Criteria Pollutant Emissions in Nonattainment and Maintenance Areas

Training Activities

Under Alternative 1, SO_2 emissions from training in the nonattainment areas were estimated at 263 tons per year (based on a worst case assumption that all training activities that may take place in the nonattainment areas would take place in the nonattainment areas (refer to calculation details presented in Appendix D, Air Quality Calculations and Record of Non-Applicability). The increase in SO_2 emissions from training in the nonattainment areas of Guam under Alternative 1 is estimated at 91 tons per year compared to SO_2 emissions from training in the nonattainment areas of Guam under the No Action Alternative, a 47-percent increase. However, these training activities can occur in other areas outside of the nonattainment areas, such as in the CNMI, Andersen Air Force Base, Naval Base Guam Munitions Site, Naval Base Guam Telecommunications Site, and many other training locations in the Study Area (see Figures 2.1-1 through 2.1-12 for training and testing areas within the MITT Study Area. In addition, all ships and aircraft associated with a training activity were fully accounted for, even though they may operate within the nonattainment area for a very limited amount of time or may not operate there at all (e.g., outside of the 2.2 mi. [3.5 km] distance from the center of the nonattainment area, at altitudes above 3,000 ft. [914 m]).

Testing Activities

Shipboard protection systems and swimmer defense testing would take place at Naval Base Guam Apra Harbor, which is within the nonattainment area around the Piti Power Plant. Broad area maritime surveillance testing may also occur within 3 nm of shore as part of Civilian Port Defense exercises, even though not all testing occurs within the nonattainment areas of Guam. SO_2 emissions from these testing activities under Alternative 1 were estimated at 0.1 ton per year. A percent increase for SO_2 emissions from testing activities in the nonattainment areas under Alternative 1 cannot be evaluated because these proposed testing activities are not currently conducted under the No Action Alternative.

3.2.3.1.2.4 General Conformity Threshold Determinations

Under Alternative 1, the emissions increase for SO_2 from all training and testing activities in the nonattainment areas of Guam above the No Action Alternative is estimated to be 91 tons per year. The *de minimis* threshold for a full conformity determination is an SO_2 emissions increase of 100 tons per year. The General Conformity Rule, therefore, does not apply under Alternative 1.

3.2.3.1.2.5 Summary – Alternative 1

Total criteria air pollutant emissions under Alternative 1 are summarized in Table 3.2-7. Under Alternative 1, the annual numbers of Navy training and testing activities in the Study Area would

increase. Emissions of all criteria pollutants would increase. Criteria air pollutants emitted in the Study Area within territorial waters could be transported ashore but would not affect the attainment status of the relevant air quality control regions. The amounts of air pollutants emitted in the Study Area and subsequently transported ashore would be minor because (1) the pollutants are emitted over large areas (i.e., the Study Area is an area source), (2) the distances the air pollutants would be transported are often large, and (3) the pollutants would be substantially dispersed during transport. The criteria air pollutants emitted over nonterritorial waters within the Study Area would be dispersed over vast areas of open ocean and thus would not cause significant harm to environmental resources in those areas.

Table 3.2-7: Estimated Annual Criteria Air Pollutant Emissions in MITT Study Area, Alternative 1

Source	Emissions by Air Pollutant (TPY)						
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Training Activities	1,052	1,436	210	677	459	412	4,246
Testing Activities	265	186	25	36	20	17	549
Total MITT Study Area	**1,317**	**1,622**	**235**	**713**	**479**	**429**	**4,759**

Notes: TPY = tons per year, CO = carbon monoxide, NO_X = nitrogen oxides, VOC = volatile organic compounds, SO_x= sulfur oxides, PM_{10} = particulate matter <10 microns, $PM_{2.5}$ = particulate matter under 2.5 microns

3.2.3.1.3 Alternative 2

3.2.3.1.3.1 Training Activities

Under Alternative 2, the annual numbers of various military training activities in the Study Area would increase according to Table 2.8-1. Therefore, emissions rates for criteria pollutants also would increase relative to emissions under the No Action Alternative. The total amounts of criteria pollutants emitted by military aircraft, vessels, ordnance and ground-based vehicles and equipment during training activities in the Study Area under Alternative 2 are shown in Table 3.2-8. Calculation details are presented in spreadsheets in Appendix D (Air Quality Calculations and Record of Non-Applicability). The percent increases in criteria pollutants range from 84 percent (for VOC) to a little above 200 percent (for NO_x). Air pollutants from training activities under Alternative 2 would not have a measurable impact on air quality in coastal waters or on adjacent land areas because of the distances from land at which the pollutants are emitted and the generally strong ventilation resulting from regional meteorological conditions. About 49 percent (including emissions beyond 12 nm) and 31 percent of training emissions would be produced beyond 3 nm and 12 nm from shore, respectively.

Table 3.2-8: Annual Criteria Air Pollutant Emissions from Training under Alternative 2

Source	Air Pollutant Emissions (TPY)					
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$
Aircraft	324	751	45	33	302	272
Vessels	492	635	155	659	124	111
Ordnance	251	4	0	0	7	7
Others	48	122	15	0	51	46
Total	**1,115**	**1,512**	**215**	**692**	**484**	**436**

Notes: TPY = tons per year, CO = carbon monoxide, NO_X = nitrogen oxides, ROG/HC = reactive organic gases/hydrocarbons, SO_x = sulfur oxides, PM_{10} = particulate matter <10 microns, $PM_{2.5}$ = particulate matter under 2.5 microns

3.2.3.1.3.2 Testing Activities

Under Alternative 2, testing activities in the Study Area would increase over those in Alternative 1. Therefore, emissions rates for criteria pollutants from Navy testing activities also would increase relative to emissions under Alternative 1. Table 3.2-9 presents criteria pollutant emissions from Navy testing activities under Alternative 2. Calculation details are presented in spreadsheets in Appendix D (Air Quality Calculations and Record of Non-Applicability). Air pollutants from testing activities under Alternative 2 would not have a measurable impact on air quality in coastal waters or on adjacent land areas because a majority of the emissions are generated beyond 3 nm from shore, and the generally strong ventilation in the area resulting from regional meteorological conditions would quickly disperse the emissions. A percent increase for criteria emissions from testing activities under Alternative 2 cannot be evaluated because, with the exception of the existing testing conducted by the Office of Naval Laboratory (which was not evaluated because of its distant location from the potential impact areas), these proposed testing activities are not currently conducted under the No Action Alternative.

Table 3.2-9: Annual Criteria Air Pollutant Emissions from Testing under Alternative 2

Jurisdiction	Emissions by Criteria Pollutant (TPY)					
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$
Aircraft	5	22	1	1	10	9
Vessels	293	180	28	40	11	10
Ordnance	1	1	0	0	1	1
Other Equipment	0	0	0	0	0	0
Total	**299**	**203**	**29**	**41**	**22**	**20**

Notes: TPY = tons per year, CO = carbon monoxide, NO_X = nitrogen oxides, ROG/HC = reactive organic gases/hydrocarbons, SO_x = sulfur oxides, PM_{10} = particulate matter <10 microns, $PM_{2.5}$ = particulate matter under 2.5 microns

3.2.3.1.3.3 Criteria Pollutant Emissions in Nonattainment and Maintenance Areas

Training Activities

Under Alternative 2, SO_2 emissions from training in the nonattainment areas was estimated at 263 tons per year (based on a worst case assumption that all training activities that may take place in the nonattainment areas would take place in the nonattainment areas). The increase in SO_2 emissions from training in the nonattainment areas of Guam under Alternative 2 is 91 tons per year compared to SO_2 emissions from training in the nonattainment areas of Guam under the No Action Alternative, a 47 percent increase. However, these training activities can occur in other areas outside of the nonattainment areas, such as in the CNMI, Andersen Air Force Base, Naval Base Guam Munitions Site, Naval Base Guam Telecommunications Site, and many other training locations in the Study Area (see Figures 2.1-1 through 2.1-12 for training and testing areas within the MITT Study Area). In addition, all ships and aircraft associated with a training activity were fully accounted for, even though they may operate within the nonattainment area for a very limited amount of time or may not operate there at all (e.g., outside of the 2.2 mi. [3.5 km] distance from the center of the nonattainment area, at altitudes above 3,000 ft. [914 m]).

Testing Activities

Shipboard protection systems and swimmer defense testing would take place at Naval Base Guam Apra Harbor, which is within the nonattainment area around the Piti Power Plant. Broad area maritime surveillance testing may also occur within 3 nm of shore as part of Civilian Port Defense exercises, even though not all testing occurs within the nonattainment areas of Guam. SO_2 emissions from this testing

activity under Alternative 2 were estimated at 0.1 ton per year. A percent increase for SO_2 emissions from testing activities in the nonattainment areas under Alternative 2 cannot be evaluated because these proposed testing activities are not currently conducted under the No Action Alternative.

3.2.3.1.3.4 General Conformity Threshold Determinations

Under Alternative 2, the emissions increase for SO_2 from all training and testing activities in the nonattainment areas of Guam above the No Action Alternative is estimated to be 91 tons per year. The *de minimis* threshold for a full conformity determination is an SO_2 emissions increase of 100 tons per year. The General Conformity Rule, therefore, does not apply under Alternative 2.

3.2.3.1.3.5 Summary – Alternative 2

Total criteria air pollutant emissions under Alternative 2 are summarized in Table 3.2-10. Under Alternative 2, the annual numbers of Navy training and testing activities in the Study Area would increase. Emissions of all criteria pollutants would increase. Criteria air pollutants emitted in the Study Area within territorial waters could be transported ashore, but would not affect the attainment status of the relevant air quality control regions. The amounts of air pollutants emitted in the Study Area and subsequently transported ashore would be minor because (1) the pollutants are emitted over large areas (i.e., the Study Area is an area source), (2) the distances the air pollutants would be transported are often large, and (3) the pollutants would be substantially dispersed during transport. The criteria air pollutants emitted over non-territorial waters within the Study Area would be dispersed over vast areas of open ocean and thus would not cause significant harm to environmental resources in those areas.

Table 3.2-10: Estimated Annual Criteria Air Pollutant Emissions by MITT Study Area, Alternative 2

Source	Emissions by Air Pollutant (TPY)						
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Training Activities	**1,115**	**1,512**	**215**	**692**	**484**	**436**	**4,454**
Testing Activities	**299**	**203**	**29**	**41**	**22**	**20**	**614**
Total MITT Study Area	**1,414**	**1,715**	**244**	**733**	**506**	**456**	**5,068**

Notes: TPY = tons per year, CO = carbon monoxide, NO_X = nitrogen oxides, VOC = volatile organic compounds, SO_x= sulfur oxides, PM_{10} = particulate matter <10 microns, $PM_{2.5}$ = particulate matter under 2.5 microns

3.2.3.1.4 Impact Conclusions for Criteria Air Pollutants

Based on the estimated levels of air pollutant emissions presented in Tables 3.2-3 through 3.2-10, (1) most of the air pollutants from training and testing activities would be released to the environment in offshore areas with few other sources of air pollutants, and (2) training and testing emissions would rapidly disperse over a large ocean area where few individuals would be exposed to them.

3.2.3.2 Hazardous Air Pollutants

3.2.3.2.1 No Action Alternative

The USEPA has designated 188 substances as hazardous air pollutants under Title III (Hazardous Air Pollutants), Section 112(g) of the CAA. Hazardous air pollutants are emitted by several processes associated with military training and testing activities, including fuel combustion. Trace amounts of hazardous air pollutants are emitted by combustion sources participating in training and testing activities, including aircraft, vessels, targets, munitions, and ground-based vehicles and equipment. The amounts of hazardous air pollutants emitted are small compared to the emissions of criteria pollutants; emission factors for most hazardous air pollutants from combustion sources are roughly three or more orders of magnitude lower than emission factors for criteria pollutants (California Air Resources Board

2007). Emissions of hazardous air pollutants from munitions use are smaller still, with emission factors ranging from roughly 10^{-5} to 10^{-15} lb. of individual hazardous air pollutant per item for cartridges to 10^{-4} to 10^{-13} lb. of individual hazardous air pollutants per item for mines and smoke cartridges (U.S. Environmental Protection Agency 2009a). As an example, 10^{-5} is equivalent to 0.0001 and 10^{-15} is equivalent to 0.00000000000001. In other words, to generate one pound of hazardous air pollutants would require the expenditure of 10,000–10,000,000,000 lb. of munitions, respectively.

3.2.3.2.1.1 Training Activities

Human health would not be impacted by training emissions of hazardous air pollutants in the Study Area under the No Action Alternative because (1) hazardous air pollutant emissions from training activities would be released to the environment mostly in offshore areas with few existing sources of air pollutants, (2) hazardous air pollutant emissions of training activities would be distributed over the entire Study Area and rapidly dispersed over a large ocean area where few individuals would be exposed to them, and (3) hazardous air pollutant emissions from training activities would be diluted through mixing in the atmosphere to a much lower ambient concentration. Residual hazardous air pollutant impacts when training is not being conducted would not be detectable. Therefore, hazardous air pollutant emissions from training for the No Action Alternative will not be quantitatively estimated in this EIS/OEIS.

3.2.3.2.1.2 Testing Activities

Human health would not be impacted by testing emissions of hazardous air pollutants in the Study Area under the No Action Alternative because (1) hazardous air pollutant emissions from testing activities would be released to the environment in a remote area with few existing sources of air pollutants, (2) hazardous air pollutant emissions of testing activities would be distributed over the entire Study Area and rapidly dispersed over a large ocean area where few individuals would be exposed to them, and (3) hazardous air pollutant emissions from testing activities would be diluted through mixing in the atmosphere to a much lower ambient concentration. Residual hazardous air pollutant impacts when testing is not being conducted would not be detectable. Therefore, hazardous air pollutant emissions from testing for the No Action Alternative will not be quantitatively estimated in this EIS/OEIS.

3.2.3.2.2 Alternative 1

3.2.3.2.2.1 Training Activities

Trace amounts of hazardous air pollutants would be emitted from sources participating in Alternative 1 training activities, including aircraft, vessels, targets, munitions, and ground-based vehicles and equipment. Hazardous air pollutants emissions under Alternative 1 would increase relative to the No Action Alternative emissions. As noted for the No Action Alternative in Section 3.2.3.2.1.1 (Training Activities), hazardous air pollutant emissions are not quantitatively estimated, but the increase in hazardous air pollutant emissions under Alternative 1 would be roughly proportional to the increase in emissions of criteria pollutants. Therefore, the amounts that would be emitted as a result of Alternative 1 activities would be somewhat greater than those emitted under the No Action Alternative, but would remain very small compared to the emissions of criteria pollutants. Training activities in the Study Area under Alternative 1 would emit hazardous air pollutants throughout the year. The potential health impacts of training-related hazardous air pollutant emissions under Alternative 1 would be the same as those discussed under the No Action Alternative.

3.2.3.2.2.2 Testing Activities

Trace amounts of hazardous air pollutants would be emitted from sources participating in Alternative 1 testing activities, including aircraft, vessels, targets, and munitions. Hazardous air pollutant emissions

would increase under Alternative 1 relative to emissions under the No Action Alternative. As noted for the No Action Alternative in Section 3.2.3.2.1, hazardous air pollutant emissions are not quantitatively estimated, but the increase in hazardous air pollutant emissions under Alternative 1 would be roughly proportional to the increase in emissions of criteria air pollutants. Therefore, the amounts that would be emitted as a result of Alternative 1 testing activities would be somewhat greater than those emitted under the No Action Alternative but would remain very small compared to the emissions of criteria air pollutants. The potential health impacts of testing-related hazardous air pollutant emissions under Alternative 1 would be the same as those discussed under the No Action Alternative.

3.2.3.2.3 Alternative 2

3.2.3.2.3.1 Training Activities

The amounts and distribution of training-related hazardous air pollutants emitted under Alternative 2 would be similar to those described under Alternative 1. The potential health impacts of training-related hazardous air pollutants emitted under Alternative 2 would be the same as those discussed under the No Action Alternative.

3.2.3.2.3.2 Testing Activities

The amounts and distribution of testing-related hazardous air pollutants emitted under Alternative 2 would be similar to those described under Alternative 1. The potential health impacts of testing-related hazardous air pollutants emitted under Alternative 2 would be the same as those discussed under the No Action Alternative.

3.2.4 Summary of Potential Impacts (Combined Impacts of All Stressors) on Air Quality

3.2.4.1 No Action Alternative

As described in Section 3.2.3.1 (Criteria Pollutants) and Section 3.2.3.2 (Hazardous Air Pollutants), emissions associated with Study Area training and testing primarily occur offshore. Fixed-wing aircraft emissions typically occur above the 3,000 ft. (914 m) mixing layer. Even though these stressors can co-occur in time and space, atmospheric dispersion would occur, so the impacts would be short term. Changes in criteria and hazardous air pollutant emissions are not expected to be detectable, so the air quality is expected to fully recover before a subsequent activity. For these reasons, impacts on air quality from combining these resource stressors are expected to be similar to the impacts on air quality for any of these stressors taken individually with no additive, synergistic, or antagonistic interactions.

3.2.4.2 Alternative 1

As described in Section 3.2.3.1 (Criteria Pollutants) and Section 3.2.3.2 (Hazardous Air Pollutants), emissions associated with Study Area training and testing under Alternative 1 primarily occur offshore. Fixed-wing aircraft emissions typically occur above the 3,000 ft. (914 m) mixing layer. Even though these stressors can co-occur in time and space, atmospheric dispersion would occur so that the impacts would be short term. Changes in criteria and hazardous air pollutant emissions are not expected to be detectable, so the air quality is expected to fully recover before a subsequent activity. For these reasons, impacts on air quality from combining these resource stressors are expected to be similar to the impacts on air quality for any of these stressors taken individually with no additive, synergistic, or antagonistic interactions. Emissions of most criteria pollutants and hazardous air pollutants are expected to increase under Alternative 1.

3.2.4.3 Alternative 2

As described in Section 3.2.3.1 (Criteria Pollutants) and Section 3.2.3.1.4 (Hazardous Air Pollutants), emissions associated with Study Area training and testing under Alternative 2 primarily occur offshore. Fixed-wing aircraft emissions typically occur above the 3,000 ft. (914 m) mixing layer. Even though these stressors can co-occur in time and space, atmospheric dispersion would occur so that the impacts would be short term. Changes in criteria and hazardous air pollutant emissions are not expected to be detectable, so the air quality is expected to fully recover before a subsequent activity. For these reasons, impacts on air quality from combining these resource stressors are expected to be similar to the impacts on air quality for any of these stressors taken individually with no additive, synergistic, or antagonistic interactions. Emissions of most criteria pollutants and hazardous air pollutants are expected to increase under Alternative 2.

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