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 constituents have been analyzed for their effects on air quality:

- Criteria Air Pollutants
- Hazardous Air Pollutants

Preferred Alternative (Alternative 1)

- Reasonably foreseeable emissions of criteria air pollutants in attainment areas would not cause federal ambient air quality standards to be exceeded.
- Reasonably foreseeable emissions of criteria air pollutants in maintenance areas would not exceed applicable federal *de minimis* levels.
- The public would not be exposed to substantial concentrations of hazardous air pollutants.

Note: Emissions thresholds for conformity requirements are termed *de minimis* levels.

3.2.1 INTRODUCTION AND METHODS

3.2.1.1 Introduction

Air pollution can threaten public health and damage the environment. Congress passed the Clean Air Act (CAA) and its amendments to regulate air pollutant emissions and ambient air quality and thus 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 its effects on public health and the natural environment, air pollution can damage 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 air 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 PM is further categorized as particulates less than or equal to 10 microns in diameter (PM_{10}) and fine PM 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 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 2010b).

National Ambient Air Quality Standards have not been established for hazardous air pollutants. Examples of hazardous air pollutants include benzene, which is found in gasoline; perchloroethylene, which is emitted by 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.[1]

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 2010b). Secondary air pollutants are 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 2010b). Ozone, a major component of photochemical smog, is a secondary air pollutant. Ozone precursors consist of two groups of chemicals: nitrogen oxides (NO_X) and organic compounds. Nitrogen oxides consist of nitric oxide (NO) and NO_2. Organic compound precursors of O_3 are 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. Various mechanical processes (e.g., abrasion, erosion, mixing, or atomization) and combustion processes emit both PM_{10} and $PM_{2.5}$ as primary air pollutants. They are generated as secondary air 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 (e.g., tons per year, pounds per hour). Typical emission factors for a source are pounds per thousand gallons of fuel burned, pounds per ton of material processed, and grams (g) per vehicle-mile (mi.) traveled.

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 that their actions conform to applicable State 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

National Ambient Air Quality Standards for criteria pollutants are presented in Table 3.2-1. Federally designated Air Quality Control Regions, or portions thereof, that exceed a standard are designated as "nonattainment" for that pollutant, while areas that comply with a standard are in "attainment" for that pollutant. An area may be nonattainment for some pollutants and attainment for others simultaneously.

[1] An area source is a two-dimensional source of diffuse air pollutant emissions (e.g., the emissions from a forest fire, a landfill, or dust from a large area of disturbed soil).

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 hours(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 hours(4)	None	
Particulate matter (PM_{10})	150 µg/m^3	24 hours(5)	Same as primary	
Particulate matter ($PM_{2.5}$)	12.0 µg/m^3	Annual(6)	15.0 µg/m^3	Annual(6)
	35 µg/m^3	24 hours(7)	Same as primary	
Ozone (O_3)	0.075 ppm (2008 std)	8 hours(8)	Same as primary	
	0.08 ppm (1997 std)	8 hours(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 hours(1)
	0.14 ppm(11) (1971 std)	24 hours(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 µg/m^3 as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that 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 nitrogen dioxide standard is 0.053 parts per million (ppm), equal to 53 parts per billion (ppb), which is shown here for the purpose of a clearer comparison with 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) Arithmetic mean. To attain these standards, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 12.0 micrograms per cubic meter (µg/m^3), primary standard, or 15.0 µg/m^3, secondary standard.
(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 O_3 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 O_3 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 (USEPA) undertakes rulemaking to address the transition from the 1997 O_3 standard to the 2008 O_3 standard.
(c) The USEPA is reconsidering these standards (established in March 2008).
(10) (a) The USEPA revoked the 1-hour O_3 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 SO_2 standards remain in effect until 1 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: µg/m^3 = micrograms/cubic meter, mg/m^3 = milligrams/cubic meter, ppb = parts per billion, ppm = parts per million, std = standard
Source: U.S. Environmental Protection Agency 2011b, updated 4 October 2011

States, 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 upon 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 attainment status for most of the Northwest Training and Testing (NWTT) Study Area (hereafter referred to as the Study Area) is unclassified because only areas within state boundaries are classified under the CAA. Marine waters within 3 nautical miles (nm) of the coast are included in the Air Quality Control Region of the adjacent land area. The 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 state marine waters are warranted. The Study Area encompasses three federally designated Air Quality Control Regions in two states (Alaska and Washington). U.S. Department of the Navy (Navy) training and testing activities offshore of Oregon and California occur exclusively more than 12 nm from shore, so Air Quality Control Regions in those states are not affected. The affected Air Quality Control Regions are shown in Figure 3.2-1 and described in Section 3.2.2.4 (Existing Air Quality).

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 Air Quality Control Regions of the United States that are designated under the CAA as nonattainment or maintenance for any criteria air pollutant (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 U.S. Code § 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.

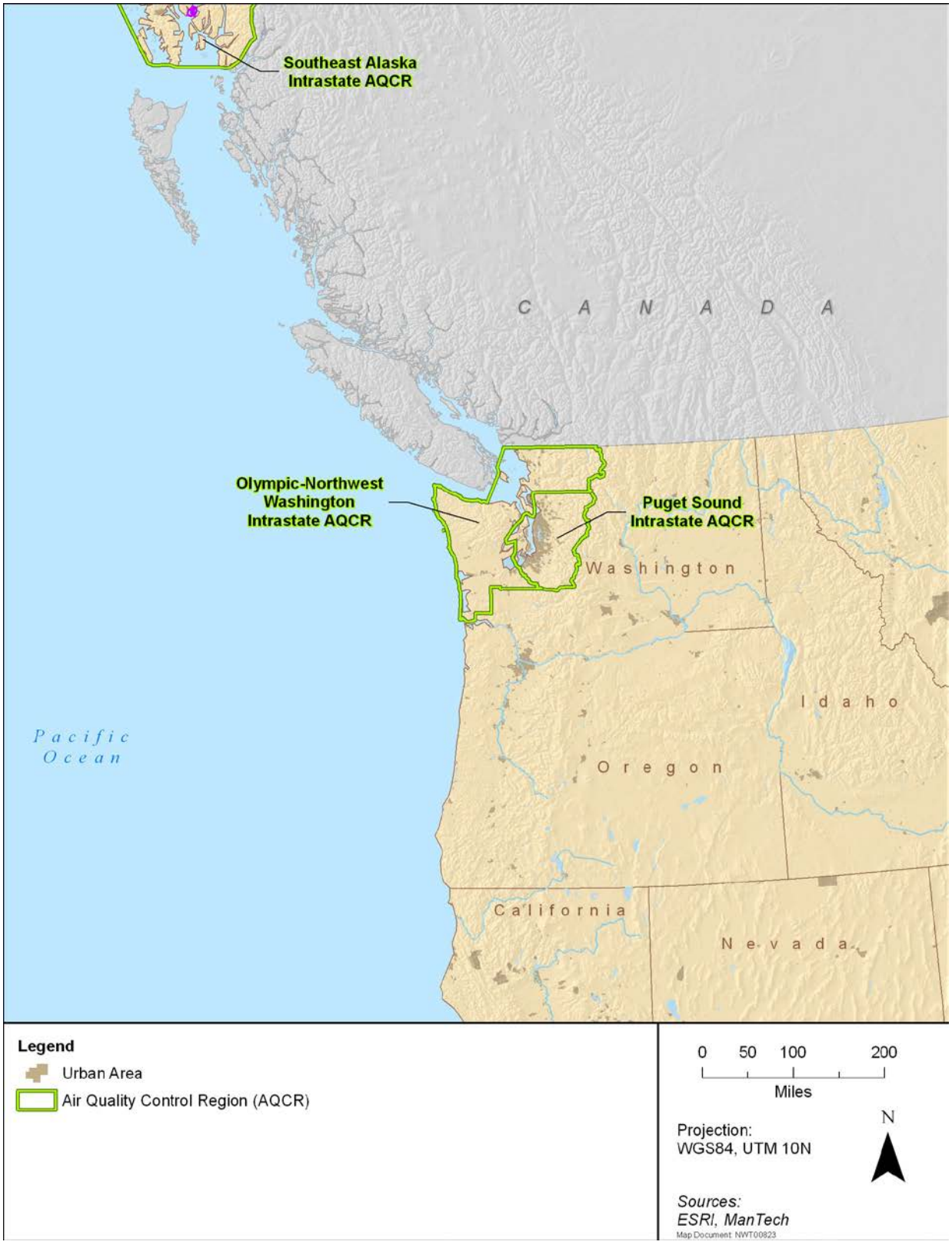

Figure 3.2-1: Air Quality Control Regions in the Northwest Training and Testing Study Area

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

Pollutant	Nonattainment or Maintenance Area Type	*De Minimis* Threshold (tons per year)
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 and maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
$PM_{2.5}$	All nonattainment and maintenance	100
Lead (Pb)	All nonattainment and maintenance	25

Notes: (1) Study Area is not in an ozone transport region. (2) CO = carbon monoxide, NO_2 = nitrogen dioxide, NO_x = nitrogen oxides, Pb = lead, $PM_{2.5}$ = particulate matter under 2.5 microns, PM_{10} = particulate matter under 10 microns, SO_2 = sulfur dioxide, VOC = volatile organic compounds
Source: U.S. Environmental Protection Agency 2011a.

Actions not subject to the General Conformity Rule include actions that occur in attainment areas and that do not generate emissions in nonattainment areas. If National Environmental Policy Act (NEPA) documentation is prepared for an agency action, the determination that the proposed action is not subject to the General Conformity Rule is described in that documentation. Otherwise, no documentation is required. This Environmental Impact Statement (EIS)/Overseas EIS (OEIS) includes the determination that actions in attainment areas that do not emit air pollutants in nonattainment areas are not subject to the General Conformity Rule.

3.2.1.2.1.3 Prevention of Significant Deterioration

The CAA defines mandatory Federal Class I areas as national parks greater than 6,000 acres, wilderness areas and national memorial parks greater than 5,000 acres, and international parks that existed in 1977. Prevention of Significant Deterioration provisions (Title 1, Part C of the CAA) were enacted to protect Class I areas from new stationary sources that could cause a Prevention of Significant Deterioration increment (amount of increased air pollution allowed in an area) to be exceeded. The Proposed Action does not include constructing or modifying a stationary source, so Prevention of Significant Deterioration requirements do not apply.

On 13 May 2010, the USEPA issued a final rule that established an 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 Program and Title V Operating Permit Program 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 Navy training and testing within U.S. territorial seas (i.e., within 12 nm of the coast) are assessed under NEPA, and (2) impacts of air pollutants emitted by Navy training and testing activities outside U.S. territorial seas are evaluated under Executive Order (EO) 12114. State waters are within the jurisdiction of the respective state and, because Alaska and Washington each have a distinct State Implementation Plan, the air quality evaluation separately analyzes those activities that emit air pollutants within those states' jurisdictions. Portions of the Study Area that lie within 3 nm of the coast in Alaska and Washington are within state air quality jurisdictions.

The analysis of health-based air quality impacts under NEPA includes estimates of criteria air pollutants for all training and testing activities where aircraft, ordnance, 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, ordnance, or targets operate at or below 3,000 ft. (914 m) above ground level or that involve vessels outside U.S. territorial seas. Air pollutants emitted more than 3,000 ft. (914 m) above ground level are considered to be above the atmospheric mixing height (also called the atmospheric planetary boundary 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 from targets and ordnance expended, are included regardless of their altitude (Chapter 4, Cumulative Impacts).

Criteria air pollutants 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 in small-, medium-, and large-caliber projectiles generate criteria pollutants when detonated. Non-explosive practice munitions contain spotting charges and propellants that generate criteria air pollutants when they function. Powered targets require fuel, generating criteria air pollutants during their operation, and towed targets generate criteria air pollutants secondarily because another aircraft or vessel is required to provide power. Targets may generate criteria air 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 air pollutants. Countermeasure flares, parachute flares, and smoke floats are designed to burn for a prescribed period, emitting criteria pollutants in the process.

The air quality analysis also addresses the hazardous air pollutants emitted by the proposed activities and assesses 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 ordnance and target use. Hazardous air pollutants are generated, in addition to criteria air 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 semivolatile 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 air 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 carbon dioxide (CO_2), CO, and PM; 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 CAA as a criteria air pollutant (virtually all radio-frequency chaff is 10 to 100 times larger than PM_{10} and $PM_{2.5}$ [Spargo et al. 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. The majority of chaff emissions during training and testing occur 3 nm or more from shore and at altitudes over 3,000 ft. (914 m), which is above the atmospheric mixing height. 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, tests indicated that the explosive charge in the impulse cartridge results in minimal releases of PM. A later study at Naval Air Station Fallon found that the release of 50,000 cartridges of chaff per year over an area of 10,000 square miles would result in an annual average PM concentration of 0.018 $\mu g/m^3$ (far below the National Ambient Air Quality Standards at the time of 50 $\mu g/m^3$ for PM_{10} and 15 $\mu g/m^3$ for $PM_{2.5}$ [Agency for Toxic Substances and Disease Registry 2003]).[2] 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 nonattainment or maintenance areas within the region of influence. To evaluate the conformity of the Proposed Action with the State Implementation Plan elements for each affected Air Quality Control Region or Air Basin, air pollutant emissions within these regions are estimated, based on an assumed distribution of the proposed training and testing activities within the respective portions of the Study Area.

Air pollutant emissions outside U.S. territorial seas are estimated and their potential impacts on air quality are assessed under EO 12114. The General Conformity Rule does not apply to activities outside of state waters because the rule pertains only to federal conformity with State Implementation Plans.

Aircraft, vessel, and ordnance operational parameters for the air quality analysis are based, wherever possible, on information from previous environmental impact reports, from Navy subject matter experts, and from established training requirements. These data and the annual numbers of each activity presented in Tables 2.8-1 to 2.8-3 were used to estimate the numbers and types of aircraft, surface ships and vessels, and munitions (i.e., potential sources of air emissions) that would be involved in each training and testing activity. Navy aircraft carriers and submarines are nuclear powered and have no air pollutant emissions associated with propulsion. Therefore, these vessels are not considered in the analysis below. Emissions sources and the approach used to estimate emissions are presented herein.

[2] The current standard for PM_{10} is 150 $\mu g/m^3$ over a 24-hour average time (see Table 3.2-1).

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. All aircraft are assumed to travel to and from training ranges at or above 3,000 ft. (914 m) above ground 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 air pollutants. 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. For each training and testing activity, estimates of the percentage of the activity time spent below 3,000 ft. (914 m) are included in the air quality emissions calculations. Representative emissions calculations are presented in Appendix D.

The types of aircraft used and the numbers of flights flown under the No Action Alternative are derived from previous Navy NEPA and EO 12114 documents and from other historical information and data. The types of aircraft identified include the typical aircraft platforms that conduct a particular training or testing activity (or the closest surrogate when information is not available), including range support aircraft (e.g., non-Navy commercial air services). For Alternatives 1 and 2, estimates of future aircraft flights are based on anticipated evolutionary changes in the Navy'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. The types of aircraft used in each training or testing activity and numbers of flights flown by such aircraft are included in the air quality emissions calculations. Representative emissions calculations are presented in Appendix D.

Time on range (activity duration) under the No Action Alternative was calculated from average times derived from range records, Navy subject matter experts, and previous EISs. To estimate time on range for each aircraft activity in Alternatives 1 and 2, the average flight duration approximated in the baseline data was used in the calculations. Estimated altitudes of activities for all aircraft were obtained from aircrew members in operational squadrons. Several testing activities are similar to training activities, and therefore similar assumptions were made for such activities in terms of aircraft type, altitude, mode, and flight duration. Where aircraft testing activities were dissimilar to training activities, assumptions for time on range were obtained from Navy subject matter experts.

Air pollutant emissions were estimated based on emission factors in 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 2.8-3 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 operations, 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. Nonmilitary commercial vessels and recreational vessels also are regularly present. These commercial and recreational vessels are not evaluated in the air quality analysis because they are not part of the Proposed Action. The methods of 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. Minor aboard sources of air pollutants necessary for ship operations and incidental to training or testing activities (e.g., support equipment, generators) were excluded from the emissions inventory.

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 were obtained from a database developed for Naval Sea Systems Command (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 are made include exhaust total hydrocarbons, CO, NO_x, PM, CO_2, and SO_2. For nonroad engines, all PM emissions are assumed to be smaller than PM_{10}, and 92 percent of the PM 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 PM 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 2.8-3, 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 or testing activity is separately conducted.

3.2.1.2.3.3 Naval Gunfire, Missiles, Bombs, Other Munitions, and Military Expended Material

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 their use, the numbers and types of munitions used during training or testing activities are first totaled. Then, generally accepted emissions factors for criteria air pollutants (U.S. Environmental Protection Agency 1995) 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 air pollutant under each alternative.

3.2.1.2.4 Sensitive Receptors

Identifying 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 exposure during periods of peak ambient air pollutant concentrations. In the Study Area, commercial and recreational users of the ocean may encounter air pollutants generated by the Proposed Action. Few such individuals are typically present, however, and the durations of their exposures to substantial concentrations of these pollutants are limited because the areas are determined to be clear of nonparticipants before activities commence. These potential receptors within the Study Area are thus 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 have increased from the preindustrial era (1750) to 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). 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 2009d; 74 Federal Register 66496, 15 December 2009).

To estimate the 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 (Eq) emissions of CO_2 (CO_2 Eq). The dominant greenhouse gas emitted is CO_2, mostly from fossil fuel combustion (85.4 percent) (U.S. Environmental Protection Agency 2009c). 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 (Tg, equivalent to 1 million metric tons or 1 billion kilograms) of CO_2 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.

The potential impacts 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.

3.2.1.4 Other Compliance Considerations, Requirements, and Practices

3.2.1.4.1 Executive Order 12088

EO 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 agencies.

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 Navy 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 that are not covered under a national security exemption.

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. Ozone 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 impacts of precursors on O_3 levels tend to occur several hours after the time of emission during periods of high solar load and may occur many miles from the source. Ozone 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 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 Northwest Training and Testing Study Area

The climate of the coastal Pacific Northwest is generally characterized by cool, dry summers and mild winters with abundant precipitation. This climate pattern is classified as Mediterranean (dry-summer subtropical) to maritime temperate/oceanic. Average annual air temperature gradually decreases and average annual precipitation gradually increases from northern California to southeastern Alaska. Total annual rainfall approximately doubles, from about 70 inches (in.) (178 centimeters [cm]) per year in northern California to over 150 in. (381 cm) per year in Ketchikan, Alaska. Minimum winter temperatures decrease from about 40 degrees Fahrenheit (°F) (4 degrees Celsius [°C]) in northern California to about 30°F (-1°C) in Ketchikan. Maximum winter temperatures decrease from about 55°F (13°C) in northern California to about 45°F (7°C) in Ketchikan. Summer air temperatures are more variable.

Offshore waters and inland areas generally have less rainfall than coastal areas, and portions of the region that lie in the rain shadow of major topographic features—such as the Olympic Range of mountains—have less rainfall. Average annual precipitation on portions of the Olympic Peninsula and coastal Alaska exceeds 200 in. (500 cm) per year. Approximately two-thirds of the region's precipitation occurs between October and March due to cold fronts sweeping down the western coast of North America from the Gulf of Alaska. This climate supports the largest temperate rain forest ecoregion (Nearctic ecozone) in the world. Both temperature and precipitation have increased during the 20th century. Average annual air temperature has increased by about 1.5°F (0.8°C).

The climate of the Study Area influences air quality. Atmospheric stability and mixing height determine the amount of vertical mixing of pollutants. Over water, the atmosphere tends to be neutral to slightly unstable. Over land, atmospheric stability is more variable, being unstable during the day, 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 from 1,640 to 3,281 ft. (500 to 1,000 m) with a slight diurnal (daytime) variation (U.S. Environmental Protection Agency 1972). The air quality analysis presented in this EIS/OEIS assumes that 3,000 ft. (914 m) above ground level is the typical maximum afternoon mixing height, and thus air pollutants emitted above this altitude do not affect ground-level air pollutant concentrations.

3.2.2.3 Regional Air Pollutant Sources and Emissions

Regional air pollutant sources include both marine activities and shore facilities. Unknown quantities of criteria and hazardous air pollutants are emitted by commercial and recreational aircraft and vessels operating in the Study Area. The types of air pollutants emitted from vessels operating in the Study Area can include CO, NO_x, sulfur oxides (SO_x) and PM from diesel fuel combustion (Markle and Brown 1995) and CO, NO_x, SO_x, polycyclic aromatic hydrocarbons, and formaldehyde from Jet Propellant-8 combustion (Ritchie et al. 2001). Other common fuels combusted by commercial and recreational aircraft and vessels include 100-low-lead (resulting in lead emissions in addition to those previously listed) and gasoline. Unknown quantities of criteria and hazardous air pollutants also are emitted by

residential, commercial, industrial, and institutional stationary and mobile sources in adjacent land areas. Regional emissions sources associated with existing Navy activities include support craft, special purpose barges, helicopters, and fixed-wing aircraft.

Air pollutant emissions from offshore coastal areas may affect onshore air quality because of prevailing onshore winds during certain seasons and at certain times of day. The influence of transport on a downwind air basin can vary widely depending on the weather. Along the coast of the Pacific Northwest, prevailing winds out of the northwest result in air pollutants dispersing to the south and southeast.

3.2.2.3.1 Washington

The portion of the Study Area that lies within the State of Washington encompasses pristine, rural, and urban areas. Sources and levels of air pollutant emissions accordingly vary widely. Warning Area 237 (W-237) and the Quinault Range Site lie offshore, west of the Olympic Peninsula, in a relatively pristine area where air pollutant emissions consist mostly of particulates from combustion of wood and from marine vessels. However, large portions of the Study Area lie within the transnational Puget Sound-Georgia Basin, where air quality is dominated by the Vancouver and Seattle-Tacoma metropolitan areas.

Air pollutants in the Puget Sound–Georgia Basin are emitted by a variety of point, line, and area sources—including large industrial point sources, major ground transportation corridors, and extensive areas of residential, commercial, and small-scale industrial development. In 2005, criteria air pollutant emissions in the 13 counties within the Study Area totaled approximately 1.67 million tons (State of Washington 2008). The coastal ranges to the west and the Cascades to the east tend to limit the regional dispersal of air pollutants, so air pollutants in Puget Sound are transported north and south, combining with air pollutants from Vancouver to the north and remaining in the atmosphere for long periods. Most of the Navy's training and testing facilities in this region are in rural areas, where they are exposed to a combination of low background concentrations of criteria pollutants from regional sources and substantial concentrations of locally emitted air pollutants such as particulates.

3.2.2.3.2 Oregon

The Study Area starts at 12 nm off the Oregon coast. In general, air pollutant sources along the Oregon coast adjacent to the Study Area consist of area sources of residential, commercial, and small-scale industrial development. Marine vessels are—in the aggregate—a major source of NO_x and PM emissions, and combustion of wood for space heating is a major source of PM. Numerous industrial point sources are located along the Columbia River, and emissions of air pollutants from these sources may increase air pollutant concentrations near the mouth of the Columbia River.

3.2.2.3.3 California

The Study Area starts at 12 nm off the California coast. In general, air pollutant sources along the northern California coast adjacent to the Study Area consist of area sources of residential, commercial, and small-scale industrial development. Marine vessels are—in the aggregate—a major source of NO_x and PM emissions, and combustion of wood for space heating is a major source of PM.

3.2.2.3.4 Alaska

The Ketchikan region of southeastern Alaska has relatively little industrial development and low population densities. Sources of air pollutant emissions in the region include electric power generation facilities, a few industrial facilities, burning of wood for heat, and mobile sources such as vessels,

aircraft, and automobiles. A large but seasonal source of air pollutant emissions in Ketchikan is cruise ships, several hundred of which dock in Ketchikan each year between May and September. Fuel combustion by cruise ships and other marine vessels generates the criteria pollutants NO_x, SO_2, CO, and PM.

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 air pollutants offshore. Much of the air pollutants found in offshore areas are transported there from adjacent land areas by low-level offshore winds, so concentrations of criteria air pollutants generally decrease with increasing distance from land. No criteria air pollutant monitoring stations are located in offshore areas, so air quality in the Study Area must be inferred from the air quality in adjacent land areas where air pollutant concentrations are monitored. The air quality in Puget Sound is generally intermediate in quality between that of offshore areas of the Pacific Ocean and adjacent onshore rural and urban areas.

3.2.2.4.1 Washington

Puget Sound Intrastate Air Quality Control Region (see Figure 3.2-1), managed by Puget Sound Clear Air Agency, encompasses Kitsap, King, Pierce, and Snohomish Counties and includes the Seattle-Tacoma metropolitan area. Puget Sound Naval Shipyard, Keyport Range Site, portions of Chinook Military Operations Area, the Explosive Ordnance Disposal Underwater Training Range in Hood Canal, Naval Base Kitsap Bangor, and portions of Dabob Bay Range Complex Site are in Kitsap County. Carr Inlet Operations Area is in Pierce County. Naval Station Everett is in Snohomish County. An urban portion of Pierce County (Wapato Hills–Puyallup River Valley) is in nonattainment of the federal 24-hour $PM_{2.5}$ standard because of smoke from fireplaces and stoves used for space heating. In addition, King, Pierce, and Snohomish Counties are a maintenance area for O_3 and CO. Kitsap County is in attainment of all National Ambient Air Quality Standards (Puget Sound Clear Air Agency 2012, U.S. Environmental Protection Agency 2012) and is not a maintenance area for any criteria air pollutant.

The Olympic Region Air Basin portion of the Olympic-Northwest Washington Air Quality Control Region, managed by Olympic Region Clean Air Agency, includes Clallam, Jefferson, Grays Harbor, Mason, Pacific, and Thurston Counties. Thurston County is an air quality maintenance area for PM_{10}. The Olympic Military Operating Area overlies part of the Olympic peninsula within the Olympic Region Air Basin. Quinault Range Site and portions of Dabob Bay Range Complex Site are in Jefferson County. Jefferson County is in attainment of the National Ambient Air Quality Standards (Olympic Region Clean Air Agency 2012, U.S. Environmental Protection Agency 2012) and is not a maintenance area for any criteria air pollutant.

The Northwest Air Basin portion of the Olympic-Northwest Washington Air Quality Control Region, managed by the Northwest Clean Air Agency, includes Island, Whatcom, and Skagit Counties. Explosives Ordnance Disposal Underwater Training Range Crescent Harbor, Chinook Military Operations Areas A and B, R-6701, and Navy 7 Operating Area (OPAREA) are in Island County, which is in attainment of the National Ambient Air Quality Standards, as well as state and regional air quality standards, for all criteria pollutants.

3.2.2.4.2 Alaska

The Navy's Southeast Alaska Acoustic Measurement Facility is in the Ketchikan Gateway Borough, within the Southeast Alaska Intrastate Air Quality Control Region (see Figure 3.2-1). Air quality in this area is

under the management of the Alaska Department of Environmental Conservation. Monitoring by Alaska Department of Environmental Conservation indicated that particulate concentrations increased during the wood smoke season (December and January), but the concentrations did not approach or exceed National Ambient Air Quality Standards. No violations of the federal standards have been observed in this area (Alaska Department of Natural Resources 2006).

3.2.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates how and to what degree the activities described in Chapter 2 could impact air quality within the Study Area. Tables 2.8-1 through 2.8-3 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 analyzed herein include:

- Criteria air pollutants
- Hazardous air pollutants

In this analysis, criteria air pollutant emissions were estimated for vessels, aircraft, and ordnance. For each alternative, emissions were estimated by Air Quality Control Region and by type of activity (training or testing). The emission estimates are provided in Appendix D. 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 Air Pollutants

The potential impacts of criteria air 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 affected Air Quality Control Regions. Emissions of criteria air 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 air pollutant emissions for each alternative are organized by activity (i.e., either training or testing). These emissions are further categorized by region (e.g., Air Quality Control Region) so that differences in background air quality, atmospheric circulation patterns, regulatory requirements, and sensitive receptors can be addressed. 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

Table 3.2-3 lists training-related criteria air pollutant and precursor emissions in the Study Area; only those air pollutants emitted below 3,000 ft. above ground level are included in this analysis (see Section 3.2.1.2.3.1, Aircraft Activities). Emissions are totaled for each Air Quality Control Region in the Study Area. Total emissions for each of these regions are then summed to arrive at the total emissions within the Study Area. Totals include aircraft and vessel emissions based on estimated numbers of vessels and aircraft involved in training activities. The air pollutants emitted in the greatest quantity are CO, NO_x, and PM.

Under the No Action Alternative, the annual numbers of Navy training activities in the Study Area would remain at baseline (existing) levels. The criteria pollutant that would be emitted in the greatest quantities by aircraft is NO_x, followed by PM (PM_{10} and $PM_{2.5}$) and CO. These emissions are associated with aircraft involvement in a variety of training activities, including anti-air warfare, electronic warfare, and mine warfare. The air pollutant emitted in the greatest quantities by surface vessels is CO, followed by NO_x and SO_x. These emissions are associated with vessel involvement in a variety of training activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant emitted in the greatest quantity by munitions is CO, which would be emitted under the No Action Alternative by a variety of munitions, including bombs, rockets, missiles, smokes, flares, and gun rounds.

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

Air Quality Control Region	Source Type	Air Pollutant Emissions (tons per year)						
		CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Olympic-Northwest Washington Intrastate (WA)	Aircraft	0.7	0.7	0.1	0.2	0.5	0.5	2.2
	Vessels	0.2	5.5	0.0	0.9	0.1	0.1	6.7
	Ordnance	0.7	0.4	0.0	0.0	0.0	0.0	1.1
	Subtotal	**1.6**	**6.6**	**0.1**	**1.1**	**0.6**	**0.6**	**10.0**
Puget Sound Intrastate (WA)	Aircraft	0.3	0.3	0.0	0.1	0.2	0.2	0.9
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.2	0.0	0.0	0.0	0.0	0.0	0.2
	Subtotal	**0.5**	**0.3**	**0.0**	**0.1**	**0.2**	**0.2**	**1.1**
Federal (3–12 nm)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
International (+12 nm)	Aircraft	5.2	23.0	1.1	5.5	10.7	10.7	45.5
	Vessels	167.8	101.1	15.0	27.5	5.7	5.7	317.1
	Ordnance	1.8	0.4	0.0	0.0	0.1	0.1	2.3
	Subtotal	**174.8**	**124.5**	**16.1**	**33**	**16.5**	**16.5**	**364.9**
Study Area	**Total**	**176.9**	**131.4**	**16.2**	**34.2**	**17.3**	**17.3**	**376.0**

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compound. (2) Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

Training activities in international waters generate approximately 97 percent (365 tons/376 tons [332 metric tons/342 metric tons]) of training-related criteria pollutant emissions in the Study Area under the No Action Alternative. The other approximately 3 percent of training-related criteria air pollutants are emitted in state waters (under the No Action Alternative, no training activities take place in federal waters). The spatial distribution of emissions reflects the locations where Navy training most regularly occurs.

Air pollutants emitted in the Study Area may be carried ashore by prevailing winds; 3 percent of training activity would occur within 3 nm of shore in Washington under the No Action Alternative. However, atmospheric mixing would substantially disperse these pollutants before they reached the coast. The contributions of air pollutants generated in the Study Area to the air quality in adjacent Air Basins

(California) or Air Quality Control Regions (Washington, Oregon) are minimal and unlikely to measurably add to existing onshore pollutant concentrations because of the large areas over which they are emitted, the distances these offshore pollutants would be transported, and their substantial dispersion during transport.

3.2.3.1.1.2 Testing

Table 3.2-4 lists testing-related criteria air pollutant and precursor emissions in the Study Area. Emissions are totaled for each Air Quality Control Region in the Study Area. Total emissions for each region are then summed to arrive at the total testing emissions within the Study Area. Totals include aircraft and vessel emissions based on estimated numbers of vessels and aircraft involved in tests. The air pollutants emitted in the greatest quantity are NO_x and CO.

Table 3.2-4: Annual Criteria Air Pollutant Emissions from Testing under the No Action Alternative

Air Quality Control Region	Source Type	Air Pollutant Emissions (tons per year)						
		CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Olympic-Northwest Washington Intrastate (WA)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	6.9	2.7	0.4	0.7	0.1	0.1	10.8
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**6.9**	**2.7**	**0.4**	**0.7**	**0.1**	**0.1**	**10.8**
Puget Sound Intrastate (WA)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	6.9	2.7	0.4	0.7	0.1	0.1	10.8
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**6.9**	**2.7**	**0.4**	**0.7**	**0.1**	**0.1**	**10.8**
Southeastern Alaska	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	4.7	1.6	0.2	0.5	<0.1	<0.1	7.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**4.7**	**1.6**	**0.2**	**0.5**	**<0.1**	**<0.1**	**7.0**
Federal (3–12 nm)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	0.0
International (+12 nm)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Study Area	**Total**	**18.5**	**7.0**	**1.0**	**1.9**	**0.2**	**0.2**	**28.6**

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compounds. (2) Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

Under the No Action Alternative, the annual numbers of Navy testing activities in the Study Area would remain at baseline (existing) levels. Criteria pollutants emitted in the Study Area may be transported ashore by periodic changes in prevailing winds but would not affect the air quality in air basins along the coast for the reasons described in Section 3.2.3.1.1.1 (Training). Under the No Action Alternative, no pollutants would be emitted by aircraft or ordnance. The air pollutants that would be emitted in the

greatest quantities by surface vessels are CO and NO_x. These emissions are associated with vessel involvement in a variety of testing activities. As shown in Table 3.2-4, testing activities in state waters account for all of the Study Area testing emissions under the No Action Alternative.

The contributions of testing-related air pollutants generated in the Study Area to the air quality in an adjacent Washington Air Quality Control Region would be minimal and unlikely to measurably add to existing onshore pollutant concentrations because of the large areas over which they are emitted, the distances these offshore pollutants would be transported, and their substantial dispersion during transport.

3.2.3.1.1.3 General Conformity Threshold Determination

The No Action Alternative is exempt from the federal General Conformity Rule because conformity is evaluated only for proposed new activities, and the No Action Alternative consists of existing activities. The areas where training and testing activities now occur are in attainment of federal air quality standards.

3.2.3.1.1.4 Summary – No Action Alternative

Criteria air pollutant emissions under the No Action Alternative are summarized in Table 3.2-5. 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) emissions from Navy training and testing activities are small compared to the amounts of air pollutants emitted by sources ashore, (2) the pollutants are emitted over large areas (i.e., the Study Area is an area source), (3) the distances the air pollutants would be transported are often large, and (4) the pollutants are 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 3.2-5: Estimated Annual Criteria Air Pollutant Emissions in Northwest Training and Testing Study Area, No Action Alternative

Source	Emissions by Air Pollutant (tons per year)						
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Training activities	176.9	131.4	16.2	34.2	17.3	17.3	376.0
Testing activities	18.5	7.0	1.0	1.9	0.2	0.2	28.6
Total Study Area	**195.4**	**138.4**	**17.2**	**36.1**	**17.5**	**17.5**	**404.6**

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compounds. (2) Table includes criteria pollutant precursors (e.g., VOC). Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

Estimates of air pollutant emissions under the No Action Alternative are a projection into the future of existing baseline emissions. Under the No Action Alternative, the annual numbers of Navy training and testing activities in the Study Area would remain at baseline levels. Emissions rates would remain constant for those pollutant sources that are not affected by other federal requirements to reduce air emissions. Any impacts of the No Action Alternative on regional air quality are reflected in the current ambient criteria air pollutant concentrations in air quality control regions ashore.

3.2.3.1.2 Alternative 1

3.2.3.1.2.1 Training

Under Alternative 1, the annual number of Navy training activities in the Study Area would increase in comparison to the No Action Alternative (baseline) levels. Emissions of criteria pollutants from training activities less than 3,000 ft. above ground level would increase relative to emissions under the No Action Alternative. Table 3.2-6 lists the estimated training-related criteria air pollutant and precursor emissions in the Study Area by Air Quality Control Region under Alternative 1. Under Alternative 1, about 2 percent of training emissions would be produced in state waters (0–3 nm offshore), about 0 percent would be produced in federal waters (3–12 nm offshore), and about 98 percent of training emissions would be produced in international waters (more than 12 nm offshore).

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

Air Quality Control Region	Source Type	Air Pollutant Emissions (tons per year)						
		CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Olympic-Northwest Washington Intrastate (WA)	Aircraft	1.0	1.0	0.1	0.3	0.7	0.7	3.1
	Vessels	0.0	0.8	0.0	0.1	0.0	0.0	0.9
	Ordnance	0.1	0.0	0.0	0.0	0.1	0.1	0.2
	Subtotal	**1.2**	**1.9**	**0.1**	**0.5**	**0.8**	**0.8**	**4.2**
Puget Sound Intrastate (WA)	Aircraft	0.3	0.3	0.0	0.1	0.2	0.2	0.9
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.1	0.0	0.0	0.0	0.1	0.1	0.2
	Subtotal	**0.5**	**0.4**	**0.0**	**0.1**	**0.4**	**0.4**	**1.1**
Federal (3–12 nm)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
International (+12 nm)	Aircraft	3.3	24.2	0.7	5.3	1.5	1.5	35.0
	Vessels	169.7	102.4	15.1	27.8	5.8	5.8	320.5
	Ordnance	1.3	0.4	0.0	0.0	0.1	0.1	1.9
	Subtotal	**174.3**	**127.0**	**15.8**	**33.1**	**7.4**	**7.4**	**357.6**
Study Area	**Total**	**176.0**	**129.3**	**16.0**	**33.7**	**8.5**	**8.5**	**363.5**

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compounds. (2) Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

The air pollutant that would be emitted in the greatest quantity by aircraft under Alternative 1 is NO_x, followed by SO_x and CO. These pollutants are emitted mostly by aircraft involved in anti-submarine warfare training activities. The air pollutant that would be emitted in the greatest quantities by surface vessels is CO, followed by NO_x and SO_x. These pollutants are emitted by vessels involved in a variety of training activities in the offshore OPAREAs, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant that would be emitted in the greatest quantity by munitions is CO, which would be emitted under Alternative 1 by bombs, rockets, missiles, smokes, flares, and gun rounds. Under Alternative 1, total training emissions would decrease by about 5 percent in the Study Area compared to the No Action Alternative. This decrease would result mostly from decreased vessel

emissions in the Olympic-Northwest Washington Intrastate Air Quality Control Region and a decrease in aircraft emissions in the offshore OPAREAs.

3.2.3.1.2.2 Testing

Under Alternative 1, the annual number of Navy testing activities in the Study Area would increase in comparison to No Action Alternative (baseline) levels. Emissions of all criteria pollutants would increase relative to emissions under the No Action Alternative. Table 3.2-7 lists the estimated testing-related criteria air pollutant and precursor emissions in the Study Area by region under Alternative 1. Under Alternative 1, emissions would increase within the Study Area. Only about 9 percent of testing emissions would be produced 3 nm or more from shore. Over 91 percent of air pollutant emissions would be produced in state waters.

Table 3.2-7: Annual Criteria Air Pollutant Emissions from Testing under Alternative 1

Air Quality Control Region	Source Type	Air Pollutant Emissions (tons per year)						
		CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Olympic-Northwest Washington Intrastate (WA)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	11.4	4.5	0.7	1.1	0.0	0.0	17.7
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**11.4**	**4.5**	**0.7**	**1.1**	**0.0**	**0.0**	**17.7**
Puget Sound Intrastate (WA)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	8.7	3.4	0.6	0.9	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**8.7**	**3.4**	**0.6**	**0.9**	**0.0**	**0.0**	**13.6**
Southeast Alaska Intrastate (AK)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	5.4	1.9	0.3	0.5	0.0	0.0	8.1
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**5.4**	**1.9**	**0.3**	**0.5**	**0.0**	**0.0**	**8.1**
Federal (3–12 nm)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
International (+12 nm)	Aircraft	0.4	2.9	0.1	0.1	0.2	0.2	3.7
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.4**	**2.9**	**0.1**	**0.1**	**0.2**	**0.2**	**3.7**
Study Area	**Total**	**25.9**	**12.7**	**1.7**	**2.6**	**0.2**	**0.2**	**43.1**

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compounds. (2) Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

As shown in Table 3.2-7, the air pollutant that would be emitted in the greatest quantity by aircraft under Alternative 1 is NO_x, followed by CO and PM (PM_{10} and $PM_{2.5}$). These emissions are associated mostly with aircraft involvement in anti-submarine warfare. As shown in Table 3.2-7, the air pollutant that would be emitted in the greatest quantities by surface vessels is CO, followed by NO_x and SO_x.

These emissions are associated with vessel involvement in a variety of testing activities. No air pollutants would be emitted by munitions, which would consist of torpedoes and sonobuoys.

3.2.3.1.2.3 General Conformity Threshold Determinations

To address the requirements of the federal General Conformity Rule, the net changes in criteria pollutant emissions associated with the Proposed Action in nonattainment and maintenance areas within the Study Area under Alternative 1 are estimated, relative to their corresponding emissions under the No Action Alternative. No training or testing activities would take place in a nonattainment area.

Under Alternative 1, two training activities could occur in a maintenance area. The Maritime Homeland Defense/Security Mine Countermeasures Integrated Exercise would occur every other year. While the location for this exercise would vary from year to year, it could occur in Puget Sound within Snohomish or King County; these counties are designated as air quality maintenance areas for O_3 and CO. Also, Naval Station Everett is one possible location for the small boat attack exercise. Consisting of several hours each of helicopter, combatant surface vessel, and small boat activity, total air pollutant emissions from these training activities would clearly be well below the *de minimis* thresholds for O_3 precursors and CO. The General Conformity Rule, therefore, is satisfied under Alternative 1. Representative air pollutant emissions calculations and a Record of Non-Applicability are provided in Appendix D.

3.2.3.1.2.4 Summary – Alternative 1

Total criteria air pollutant emissions under Alternative 1 are summarized in Table 3.2-8. Under Alternative 1, the annual numbers of Navy training and testing activities in the Study Area would increase. Total emissions of criteria pollutants would decrease by approximately 0.5 percent; however, emissions of particulates would decrease by about 50 percent. Criteria air pollutants emitted in the Study Area within state 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) emissions from Navy training and testing activities would be small compared to the amounts of air pollutants emitted by sources ashore, (2) the pollutants are emitted over large areas (i.e., the Study Area is an area source), (3) the distances the air pollutants would be transported are often large, and (4) 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 3.2-8: Estimated Annual Criteria Air Pollutant Emissions in the Northwest Training and Testing Study Area under Alternative 1

Source	Emissions by Air Pollutant (tons per year)						
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Training activities	176.0	129.3	16.0	33.7	8.5	8.5	363.5
Testing activities	25.9	12.7	1.7	2.6	0.2	0.2	43.1
Total Study Area	**201.9**	**142.0**	**17.7**	**36.3**	**8.7**	**8.7**	**406.6**
No Action Alternative	**403.8**	**284.0**	**35.4**	**72.6**	**17.4**	**17.4**	813.2
Net change (tons per year)	6.5	3.6	0.5	0.2	-8.8	-8.8	**-406.6**
Net change (%)	3.3	2.6	2.9	0.6	-50.3	-50.3	-50.0

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compounds. (2) Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

3.2.3.1.3 Alternative 2

3.2.3.1.3.1 Training

Under Alternative 2, the annual number of Navy training activities in the Study Area would increase in comparison to the No Action Alternative (baseline) levels. Emissions of all criteria pollutants would increase relative to emissions under the No Action Alternative. Table 3.2-9 lists the estimated training-related criteria air pollutant and precursor emissions in the Study Area by region under Alternative 2. Under Alternative 2, about 1 percent of training emissions would be produced in state waters (0–3 nm offshore), less than 1 percent would be produced in federal waters (3–12 nm offshore), and about 99 percent of training emissions would be produced in international waters (more than 12 nm offshore).

The air pollutant that would be emitted in the greatest quantity by aircraft under Alternative 2 is NO_x, followed by SO_x and CO. These pollutants are emitted mostly by aircraft involved in anti-submarine warfare training activities. The air pollutant that would be emitted in the greatest quantities by surface vessels is CO, followed by NO_x and SO_x. These pollutants are emitted by vessels involved in a variety of training activities, including anti-submarine warfare, anti-surface warfare, and electronic warfare. The air pollutant that would be emitted in the greatest quantity by munitions is CO, which would be emitted under Alternative 2 by bombs, rockets, missiles, smokes, flares, and gun rounds. Under Alternative 2, total training emissions would decrease by about 4 percent in the Study Area compared to the No Action Alternative. This decrease would result mostly from decreased vessel emissions in the Olympic-Northwest Washington Intrastate Air Quality Control Region and a decrease in aircraft emissions in the offshore OPAREAs.

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

Air Quality Control Region	Source Type	Air Pollutant Emissions (tons per year)						
		CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Olympic-Northwest Washington Intrastate (WA)	Aircraft	1.0	1.0	0.1	0.3	0.7	0.7	3.1
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.1	0.0	0.0	0.0	0.1	0.1	0.2
	Subtotal	**1.1**	**1.0**	**0.1**	**0.3**	**0.8**	**0.8**	**3.3**
Puget Sound Intrastate (WA)	Aircraft	0.3	0.3	0.0	0.1	0.2	0.2	0.9
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	1.0
	Ordnance	0.1	0.0	0.0	0.0	0.1	0.1	0.2
	Subtotal	**0.4**	**0.3**	**0.0**	**0.1**	**0.3**	**0.3**	**1.1**
Federal (3–12 nm)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
International (+12 nm)	Aircraft	3.3	24.2	0.7	5.3	1.5	1.5	35.0
	Vessels	169.7	102.4	15.1	27.8	5.8	5.8	320.8
	Ordnance	1.3	0.4	0.0	0.0	0.1	0.1	1.8
	Subtotal	**174.3**	**127.0**	**15.8**	**33.1**	**7.4**	**7.4**	**357.6**
Study Area	**Total**	**175.8**	**128.3**	**15.9**	**33.5**	**8.5**	**8.5**	**362.0**

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compounds. (2) Air pollutant emissions estimated to the nearest ton per year. Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

3.2.3.1.3.2 Testing

Under Alternative 2, the annual number of Navy testing activities in the Study Area would increase in comparison to the No Action Alternative (baseline) levels. Emissions of all criteria pollutants would increase relative to emissions under the No Action Alternative. Table 3.2-10 lists the estimated testing-related criteria air pollutant and precursor emissions in the Study Area by air quality control region under Alternative 2. Only about 9 percent of testing-related emissions would be produced more than 3 nm offshore. Over 91 percent of these emissions would be produced within 3 nm of shore.

The air pollutant that would be emitted in the greatest quantity by aircraft under Alternative 2 (Table 3.2-10) is NO_x, followed by CO and PM (PM_{10} and $PM_{2.5}$). These pollutants are emitted mostly by aircraft involved in anti-submarine warfare. The air pollutant that would be emitted in the greatest quantities by surface vessels (Table 3.2-10) is CO, followed by NO_x and SO_x. These pollutants are emitted by vessels involved in a variety of testing activities. No air pollutants would be emitted by munitions, which would consist of torpedoes and sonobuoys.

Table 3.2-10: Annual Criteria Air Pollutant Emissions from Testing under Alternative 2

Air Quality Control Region	Source Type	Air Pollutant Emissions (tons per year)						
		CO	NO_x	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Olympic-Northwest Washington Intrastate (WA)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	12.4	5.0	0.7	1.3	0.2	0.2	19.6
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**12.4**	**5.0**	**0.7**	**1.3**	**0.2**	**0.2**	**19.6**
Puget Sound Intrastate (WA)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	9.5	3.7	0.6	1.0	0.2	0.2	15.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**9.5**	**3.7**	**0.6**	**1.0**	**0.2**	**0.2**	**15.0**
Southeastern Alaska Intrastate (AK)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	5.4	1.9	0.3	0.6	0.0	0.0	8.2
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**5.4**	**1.9**	**0.3**	**0.6**	**0.0**	**0.0**	**8.2**
Federal (3–12 nm)	Aircraft	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
International (+12 nm)	Aircraft	0.4	3.2	0.1	0.1	0.2	0.2	4.0
	Vessels	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ordnance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.4**	**3.2**	**0.1**	**0.1**	**0.2**	**0.2**	**4.0**
Study Area	**Total**	**27.7**	**13.8**	**1.7**	**3.0**	**0.6**	**0.6**	**46.8**

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compounds. (2) Air pollutant emissions estimated to the nearest ton per year. Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

3.2.3.1.3.3 General Conformity Threshold Determinations

To address the requirements of the federal General Conformity Rule, the net changes in criteria pollutant emissions associated with the Proposed Action in nonattainment and maintenance areas within the Study Area under Alternative 2 are estimated, relative to their corresponding emissions under the No Action Alternative. No training or testing activities would take place in a nonattainment area.

Under Alternative 2, two activities could occur in a maintenance area. The Maritime Homeland Defense/Security Mine Countermeasures Integrated Exercise would occur once per year. While the location for this exercise would vary from year to year, it could occur in Puget Sound within Snohomish or King County; these counties are designated as air quality maintenance areas for O_3 and CO. Also, Naval Station Everett is one possible location for the small boat attack exercise. Consisting of several hours each of helicopter, combatant surface vessel, and small boat activity, total air pollutant emissions from these training activities would clearly be well below the *de minimis* thresholds for O_3 precursors and CO. The General Conformity Rule, therefore, is satisfied under Alternative 2. Representative air pollutant emissions calculations and a Record of Non-Applicability are provided in Appendix D.

3.2.3.1.3.4 Summary – Alternative 2

Criteria air pollutant emissions under Alternative 2 are summarized in Table 3.2-11. Under Alternative 2, the annual numbers of Navy training and testing activities in the Study Area would increase relative to the No Action Alternative. Total emissions of criteria pollutants would decrease slightly, due to minor changes in the numbers of several training activities. Criteria air pollutants emitted in the Study Area 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 minimal because (1) emissions from Navy training and testing activities would be small compared to the amounts of air pollutants emitted by sources ashore, (2) the air pollutants would be emitted over a large area, (3) the distances the air pollutants would be transported are often large, and (4) 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 3.2-11: Estimated Annual Criteria Air Pollutant Emissions in Northwest Training and Testing Study Area, Alternative 2

Source	Emissions by Air Pollutant (tons per year)						
	CO	NO_X	VOC	SO_x	PM_{10}	$PM_{2.5}$	Total
Training activities	173.0	123.2	15.6	32.4	8.2	8.2	352.4
Testing activities	27.7	13.8	1.7	3.0	0.6	0.6	46.8
Total Study Area	**200.7**	**137.0**	**17.3**	**35.4**	**8.8**	**8.8**	**399.2**
No Action Alternative	**401.4**	**274.0**	**34.6**	**70.8**	**17.6**	**17.6**	**798.4**
Net change (tons per year)	5.3	-1.4	0.1	-0.7	-8.7	-8.7	-399.2
Net change (%)	2.7	-1.0	0.6	-1.9	-50	-50	-50.0

Notes: (1) CO = carbon monoxide, NO_X = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, PM_{10} = particulate matter ≤ 10 microns in diameter, SO_x = sulfur oxides, VOC = volatile organic compounds. (2) Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. Only air pollutants emitted below 3,000 feet above ground level are included in the analysis. $PM_{2.5}$ is included in PM_{10}.

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 Navy 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, and munitions. 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} pounds (lb.) of individual hazardous air pollutants 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^{-4} is equivalent to 0.0001 and 10^{-14} is equivalent to 0.00000000000001. To generate 1 lb. of hazardous air pollutants would require the expenditure of 10,000–10 trillion lb. of munitions.

3.2.3.2.1.1 Training

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 in a remote area (the ocean) 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 Proposed Action will not be quantitatively estimated in this EIS/OEIS.

3.2.3.2.1.2 Testing

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 (the ocean) 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 Proposed Action will not be quantitatively estimated in this EIS/OEIS.

3.2.3.2.2 Alternative 1

3.2.3.2.2.1 Training

Trace amounts of hazardous air pollutants would be emitted from sources participating in Alternative 1 training 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 (No Action Alternative), hazardous air pollutant emissions

are not quantitatively estimated, but the change in emissions of hazardous air pollutants under Alternative 1 would be roughly proportional to the change in emissions of criteria air 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 air pollutants. 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

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 (No Action Alternative), hazardous air pollutant emissions are not quantitatively estimated, but the change in emissions of hazardous air pollutants under Alternative 1 would be roughly proportional to the change 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

The amounts and distribution of training-related hazardous air pollutants emitted under Alternative 2 would be similar to those described under Alternative 1. The only difference is that the maritime homeland defense exercise would occur once per year. 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

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.

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

3.2.3.3.1 No Action Alternative

As discussed in Sections 3.2.3.1 (Criteria Air Pollutants) and 3.2.3.2 (Hazardous Air Pollutants), emissions associated with Study Area training and testing primarily occur offshore, with 90 percent of emissions occurring 12 nm or more from shore. 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 ensure that the impacts would be short term. Changes in criteria and hazardous air pollutant emissions are not expected to be detectable, so air quality is expected to fully recover before a subsequent activity. For these reasons, impacts on air quality from combinations of these resource stressors are expected to be similar to the impacts on air quality for any stressor taken individually, with no additive, synergistic, or antagonistic interactions.

3.2.3.3.2 Alternative 1

As discussed in Sections 3.2.3.1 (Criteria Air Pollutants) and 3.2.3.2 (Hazardous Air Pollutants), emissions associated with Study Area training and testing under Alternative 1 primarily occur offshore, with 90 percent of emissions occurring at least 12 nm 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 ensure that the impacts would be short term. Air quality is expected to fully recover before a subsequent activity. For these reasons, the impacts on air quality from combinations of these resource stressors are expected to be similar to the impacts on air quality for any stressor 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.

3.2.3.3.3 Alternative 2

As discussed in Sections 3.2.3.1 (Criteria Air Pollutants) and 3.2.3.2 (Hazardous Air Pollutants), emissions associated with Study Area training and testing under Alternative 2 primarily would occur at least 12 nm 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 ensure that the impacts would be short term. Air quality is expected to fully recover before a subsequent activity. For these reasons, impacts on air quality from combinations of these resource stressors are expected to be similar to the impacts on air quality for any stressor 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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