CHAPTER 5. AIR QUALITY

5.1 AFFECTED ENVIRONMENT

This section discusses the affected air quality environment by first providing a definition of air quality and an overview of regulations, definitions of stationary and mobile sources, greenhouse gases, and air quality information specific to Guam (monitoring programs, climate) in Section 5.1.1. The following four sections then provide information on ambient air quality conditions in each of the four regions of influence (ROIs) on Guam – North, Central, Apra Harbor, and South – and sensitive receptors in each ROI (Sections 5.1.2 through 5.1.5).

5.1.1 Definition of Resource

Air quality is defined by ambient air concentrations of specific pollutants of concern with respect to the health and welfare of the general public. Air quality can be affected by air pollutants produced by mobile sources, such as vehicular traffic, aircraft, or non-road equipment used for construction activities; and by fixed or immobile facilities, referred to as "stationary sources." Stationary sources can include combustion and industrial stacks and exhaust vents. Potential air quality effects on Guam would occur from both construction and operational activities associated with implementation of the proposed action and associated alternatives.

5.1.1.1 Regulatory Overview

The United States (U.S.) Environmental Protection Agency (USEPA), under the requirements of the 1970 Clean Air Act (CAA), as amended in 1977 and 1990 (Clean Air Act Amendments [CAAA]), has established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 Code of Federal Regulations [CFR] 50): carbon monoxide (CO), nitrogen dioxides (NO_2), ozone (O_3) (with nitrogen oxides [NO_x] and volatile organic compounds [VOCs] as precursors), particulate matter (PM) (PM_{10}—less than 10 microns in particle diameter; $PM_{2.5}$—less than 2.5 microns in particle diameter), lead (Pb), and sulfur dioxide (SO_2).

The NAAQS include primary and secondary standards as listed in Table 5.1-1. The primary standards were established to protect human health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Typical sensitive land uses protected by the primary standards are public accessible areas used by these populations, such as residences, hospitals, libraries, churches, parks, playgrounds, schools, etc. Secondary standards set limits to protect the environment, including plants and animals, from adverse effects associated with pollutants in the ambient air. A description of the criteria pollutants and their health and environmental impacts is presented in Volume 9, Appendix I, Section 2.1 National Ambient Air Quality Standards.

Areas where concentration levels are below the NAAQS for a criteria pollutant are designated as being in "attainment." Areas where a criteria pollutant level equals or exceeds the NAAQS are designated as being in "nonattainment." Based on the severity of the pollution problem, nonattainment areas are categorized as marginal, moderate, serious, severe, or extreme. Where insufficient data exist to determine an area's attainment status, it is designated as either unclassifiable or in attainment.

Table 5.1-1. U.S. National and Guam Ambient Air Quality Standards

Pollutant and Averaging Time	*Primary Standard*[1]	*Secondary Standard*[1]
Carbon Monoxide		
1-Hour Maximum[2]	35 ppm	None
8-Hour Maximum[2]	9 ppm	
Nitrogen Dioxide		
Annual Arithmetic Mean[3]	100	100
Ozone		
8-Hour Average[4]	0.075 ppm	0.075 ppm
Particulate Matter[5]		
PM_{10}		
24-Hour Average[6]	150	150
$PM_{2.5}$		
Annual Arithmetic Mean[3]	15	15
24-Hour Average[7]	35	35
Lead		
Quarterly Arithmetic Mean[8]	1.5	1.5
Rolling 3-Month Average[9]	0.15	0.15
Sulfur Dioxide		
Annual Arithmetic Mean[3, 10]	0.03 ppm (80 µg/m^3)	—
3-Hour Maximum[2]	—	0.5 ppm (1300 µg/m^3)
24-Hour Maximum[2,10]	0.14 ppm (365 µg/m^3)	—
1-Hour Average[11]	0.075ppm (195 µg/m^3)	—

Legend: — = not available; ppm = parts per million.

Notes:

[1] All concentrations in micrograms per cubic meter of air (µg/m^3), except where noted.

[2] Not to be exceeded more than once a year.

[3] Not to be exceeded during any calendar year.

[4] Standard attained when 3-year average of annual 4th-highest daily maximum 8-hour concentration is below 0.075 ppm.

[5] PM_{10}: particulate matter diameter of 10 microns or less; $PM_{2.5}$: particulate matter diameter of 2.5 microns or less.

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

[7] Standard attained when the annual highest 98th percentile of 24-hour concentration over 3 years is below 35 µg/m^3.

[8] The quarterly lead standard is not to be exceeded during any calendar quarter.

[9] Any three-month average exceeding 0.15 µg/m^3 within a three-year period will be considered a violation of the NAAQS. Final rule signed October 15, 2008.

[10] Revoked on June 2, 2010.

[11] Standard attained when the 99th percentile of daily highest level over 3 years is below 0.075 ppm. *Sources*: 40 CFR 50 and Guam Environmental Protection Agency (GEPA) (2004).

The proposed action would occur in various areas of Guam. Many of the areas are currently designated as attainment areas for all criteria pollutants. However, two areas near power plants are designated as nonattainment areas for SO_2 (Figure 5.1-1), as follows:

- Piti: Portion of Guam within a 2.2-mile (mi) (3.5-kilometer [km]) radius of the Piti Power Plant
- Tanguisson: Portion of Guam within a 2.2-mi (3.5-km) radius of the Tanguisson Power Plant.

As cited in a USEPA waiver decision, both areas are designated nonattainment for SO_2 as a result of monitored and modeled exceedances in the 1970s. Since that time, changes have been made to these power generation facilities. In accordance with 40 CFR Parts 80 and 86, both plants were rebuilt, upgrading their emission controls in the 1990s. Based on these improvements, Guam has submitted a redesignation request to USEPA for the Piti area. The pending redesignation request shows that the Piti power plant is now in attainment. In addition, as both plants are located on the western side of the island and the trade winds blow persistently from east-to-west (Section 5.1.1.5), the impact of the SO_2 emissions on the people of Guam from the power plants is reduced. Mobile sources, such as cars, are a minor contributor to SO_2 emissions.

However, on June 3, 2010 USEPA issued a new a final new health standard for SO_2, setting the one-hour SO_2 health standard at 75 parts per billion (ppb), a level designed to protect against short-term exposures ranging from five minutes to 24 hours. USEPA revokes the previous 24-hour and annual SO_2 health standards. The attainment designation based on the new standard is anticipated to occur in 2012.

Clean Air Act General Conformity

The 1990 amendments to the CAA (CAAA) require federal agencies to ensure that their actions conform to the State Implementation Plan (SIP) in a nonattainment area. Conformity to an SIP, as defined in the CAAA, means reducing the severity and number of violations of the NAAQS to achieve attainment of the standards. The federal agency responsible for an action is required to determine whether its action conforms to the applicable SIP. USEPA has developed two sets of conformity regulations—for transportation projects and non-transportation-related projects, respectively:

- Transportation projects developed or approved under the Federal Aid Highway Program or Federal Transit Act are governed by transportation conformity regulations (40 CFR Parts 51 and 93), that became effective December 27, 1993 and were revised August 15, 1997.
- Non-transportation projects are governed by general conformity regulations (40 CFR Parts 6, 51, and 93), described in the final rule for Determining Conformity of General Federal Actions to State or Federal Implementation Plans, published in the Federal Register on November 30, 1993. The General Conformity Rule (GCR) became effective January 31, 1994 and was revised on March 24, 2010 (40 CFR Parts 51 and 93).

As the proposed action components are non-transportation projects and would potentially involve activities in Piti and Tanguisson SO_2 nonattainment areas, the GCR applies to the proposed activities within the nonattainment areas. Therefore, a subsequent general conformity applicability analysis is required.

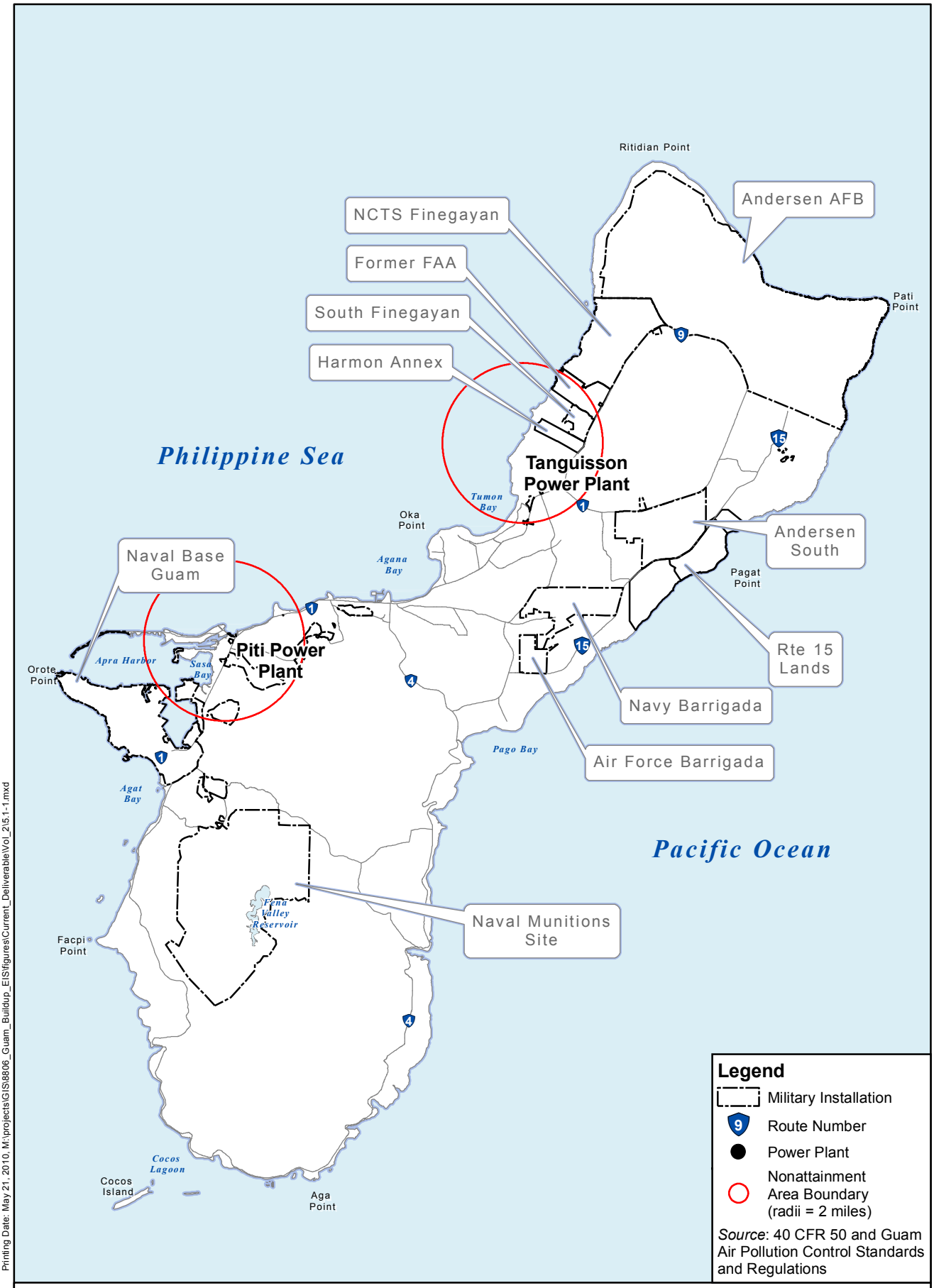

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Figure 5.1-1
Guam SO_2 Non-Attainment Areas

5.1.1.2 Stationary Sources

Stationary sources of air emissions at the various sites that could be affected by the proposed action include combustion turbines, boilers, generators, and fuel tanks. The CAAA set permit rules and emission standards for pollution sources of certain sizes. An air permit application is submitted by the prospective owner or operator of an emitting source in order to obtain approval of the source construction permit. A construction permit generally specifies a time period within which the source must be constructed. Permits should be reviewed for any modifications to the site or the air emissions sources to determine permit applicability. USEPA oversees the programs that grant stationary source operating permits (Title V) and new or modified major stationary source construction and operation permits. The New Source Review (NSR) program requires new major stationary sources or major modification of existing major stationary sources of pollutants to obtain permits before initiating construction. The New Source Performance Standards apply to sources emitting criteria pollutants, while the National Emission Standards for Hazardous Air Pollutants apply to sources emitting Hazardous Air Pollutants (HAPs).

HAPs, also known as toxic air pollutants, are chemicals that can cause adverse effects to human health or the environment. The CAAA directed USEPA to set standards for all major sources of air toxics. USEPA established a list of 188 HAPs that includes substances that cause cancer, neurological, respiratory, and reproductive effects. The Title V major source thresholds for pollutant emissions that are applicable to Guam are:

- 100 tons per year (TPY) for any criteria pollutant
- 25 TPY total HAPs
- 10 TPY for any one HAP

USEPA also established Prevention of Significant Deterioration (PSD) regulations to ensure that air quality in attainment areas does not significantly deteriorate as a result of construction and operation of major stationary sources, and to allow future industrial growth to occur. A typical major PSD source is classified as anything with the potential to emit 250 TPY of any regulated pollutant in an attainment area. However, for several types of major source operations, including fossil fuel–fired steam electric plants of more than 250 million British Thermal Units (Btu) per hour heat input, 100 TPY is the major PSD source threshold.

Since Guam has two nonattainment areas for the SO_2 NAAQS, major new sources or major modifications to existing major sources located in nonattainment areas must meet the more stringent nonattainment NSR requirements.

The GEPA has adopted the USEPA-established stationary source regulations discussed previously and acts as the administrator to enforce stationary source air pollution control regulations in Guam.

5.1.1.3 Mobile Sources

Typical mobile sources include aircraft, aircraft ground support equipment, on-road and non-road vehicles, and construction equipment. The emissions from these mobile sources are regulated under the CAA Title II that establishes emission standards that manufacturers must achieve. Therefore, unlike stationary sources, no permitting requirements exist for operating mobile sources.

Aircraft and Ground Support Equipment

USEPA has developed guidance to evaluate aircraft and associated ground support equipment operational emissions, which is provided in The Procedures of Emission Inventory Preparation, Volume IV: Mobile Sources (USEPA 1992). Aircraft engines emit pollutants during all phases of operation: climb, approach,

and cruise. According to USEPA, only emissions emitted in the atmospheric mixing layer have a potential air quality impact on ground-level ambient concentrations. The mixing layer is the air layer between the ground and the height above which the vertical mixing of pollutants decreases significantly. The USEPA recommends that a default mixing layer of 3,000 feet (ft) (914 meters [m]) be used in aircraft emission calculations.

On-Road Vehicles

Criteria Pollutants

USEPA has established guidance for conducting localized CO concentration impact analysis for on-road vehicle operations within offsite sensitive neighborhoods. Vehicle CO exhaust is one of the major concerns for on-road vehicle operations. CO is considered a site-specific pollutant with higher concentrations found adjacent to roadways, especially near congested, signalized intersections. Mobile-source CO air quality impacts are typically evaluated through a micro-scale analysis of traffic-related emissions at selected intersections. A micro-scale analysis of localized traffic-related CO concentrations is performed using the procedures outlined by USEPA in A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections (USEPA 1995) and Mobile6 User's Guide (USEPA 2003).

The modeling performed does not include reductions that would be achieved as a result of the Energy Independence and Security Act of 2007. The Energy Independence and Security Act includes several sections that address reducing petroleum/increasing alternative fuel use including:

- Only acquiring light-duty motor vehicles or medium-duty passenger vehicles that are "low greenhouse gas emitting vehicles," or demonstrating that cost-effective policies have been adopted to reduce petroleum consumption sufficiently to achieve a comparable reduction in greenhouse gas emissions.
- At least a 20% reduction in annual petroleum consumption and a 10% increase in annual alternative fuel consumption by 2015 from a 2005 baseline consumption level. Interim milestones will be established.
- Installation of at least one renewable fuel pump at each federal fleet fueling center by 2010.

Volume 6 (Section 7.2 Methodology) and Volume 9 (Appendix I, Section 3.3, Off Base On-road Vehicle Operational Emissions and Impact) provide greater detail on modeling procedures and present detailed results from the on-road vehicle related criteria pollutant emissions and CO concentrations predicted under various alternatives.

Mobile Source Air Toxics

USEPA also regulates air toxics that include pollutants known or suspected to cause cancer and/or other serious health effects. Most air toxics originate from manmade sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries). The CAA identified 188 air toxics. In 2001, USEPA identified a list of 21 Mobile Source Air Toxics (MSATs) and highlighted six of them as priority MSATs. Since 2001, USEPA has conducted an extensive review of the literature to produce a list of the compounds identified in the exhaust or evaporative emissions from on-road and non-road equipment, as well as alternative fuels. This list currently includes approximately 1,000 compounds, many of which are emitted in trace amounts.

In February 2007, USEPA finalized a rule to reduce hazardous air pollutants from mobile sources (Control of Hazardous Air Pollutants from Mobile Sources, February 9, 2007). The rule limits the

benzene content of gasoline and reduces toxic emissions from passenger vehicles and gas cans. USEPA estimates that in 2030 this rule would reduce total emissions of MSATs by 330,000 tons and VOC emissions (precursors to O_3 and $PM_{2.5}$) by more than one million tons (USEPA 2009d). In addition to controlling pollutants, such as hydrocarbons, particulate matter, and nitrogen oxides, USEPA's recent regulations controlling emissions from highway vehicles and non-road equipment will result in large air toxic reductions.

Non-Road Vehicle and Construction Equipment

In contrast to operational activities, construction activities are usually of short duration and produce only temporary air quality effects. However, the cumulative impacts of large-scale construction activities occurring over many years could cause adverse localized and regional air quality effects. USEPA has specifically developed the NONROAD emission factor model to estimate construction equipment emissions (USEPA 2008). This model is used in association with construction activity data and equipment model and size data to predict construction period emissions.

5.1.1.4 Ambient Air Quality Monitoring

The local government of Guam has not collected ambient air quality data since 1991. Therefore, no existing ambient air quality data are available to represent current air quality conditions with respect to the criteria pollutants for which the NAAQS were established.

Historical data are available from 1972 through 1991, when ambient air quality data were collected at a number of sites through a USEPA-sponsored monitoring program. The monitored pollutants were total suspended particles, SO_2, NO_2, and NO_x. In 1991, PM_{10} was monitored in addition to total suspended particles.

In 1999, the Guam Power Authority (GPA) established a network of five stations to measure SO_2 for one year, from the fall of 1999 through the summer of 2000. None of these monitors were placed close to a major stationary source and the observed SO_2 concentrations at these stations were all far below the 24-hour SO_2 NAAQS.

Because of the lack of ambient monitoring data, the existing air quality conditions on Guam cannot be evaluated by a direct comparison of the ambient pollutant concentration levels with the NAAQS. Instead, the existing air quality conditions around each ROI were based on a summary of major emission sources within that ROI. The localized air quality condition can be correlated with the close proximity of major emission sources or areas with the level of emissions identified. In general, the greater the amount of emissions (in TPY) that a source emits, the greater air quality impacts it generates. Receptors close to major emission sources that have potential to emit a large quantity of emissions tend to have more air quality concerns than those located far from these sources. However, since the NAAQS are established based on a concentration level rather than an emissions level (in TPY), the emissions levels provided in this chapter provide a qualitative picture around local emission sources, but cannot be used as a quantitative indicator of the affected air quality environment in a specific ROI.

5.1.1.5 Climate

The climate on Guam is characterized as tropical marine. The weather is generally hot and very humid with little seasonal temperature variation. Guam has two seasons, the dry season (January–June) and the wet season (July–December). During the dry season, the prevailing winds (tradewinds) from the east and northeast intensify and tend to blow emissions from major stationary sources located along the west shoreline (e.g., elevated emissions from Cabras Power Plant and other power plant stacks) towards the

ocean. However, shoreline sea breeze circulations can modify the dominant wind, complicating the wind pattern along the western shoreline of Guam. Under a weak synoptic wind pattern during the wet season, the sea breeze circulation can introduce spatial and diurnal variation in the winds along the shoreline. The effects of the sea breeze circulation could increase the air quality impacts of the emissions from existing power plants located close to the shoreline. Downwind sensitive receptor areas normally experience greater potential impacts from both stationary and mobile source emissions, particularly under conditions of low wind speed.

5.1.1.6 Greenhouse Gas Emissions

Greenhouse gases (GHGs) are compounds that contribute to the greenhouse effect. The greenhouse effect is a natural phenomenon where gases trap heat within the surface-troposphere (lowest portion of the earth's atmosphere) system, causing heating (radiative forcing) at the surface of the earth. The primary long-lived GHGs directly emitted by human activities are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Although CO_2, CH_4, and N_2O occur naturally in the atmosphere, their concentrations have increased by 38%, 149%, 23%, respectively, from the preindustrial era (1750) to 2007/2008 (USEPA 2009a). These gases influence the global climate by trapping heat in the atmosphere that would otherwise escape to space. The heating effect from these gases is considered the probable cause of the global warming observed over the last 50 years (USEPA 2009a). Global warming and climate change can affect many aspects of the environment. Not all effects of GHGs 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 ozone levels.

The USEPA Administrator has recognized potential risks to public health or welfare, and on December 7, 2009 (USEPA 2009b) signed an endangerment finding regarding GHGs under Section 202(a) of the Clean Air Act (CAA), which finds that the current and projected concentrations of the six key well-mixed GHGs – CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6 in the atmosphere threaten the public health and welfare of current and future generations.

To estimate global warming potential (GWP), the U.S. quantifies GHG 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* (UNFCCC 1995) reporting procedures. All GWPs are expressed relative to a reference gas, CO_2, which is assigned a GWP equal to 1. The five other GHGs have a greater GWP than CO_2, ranging from 21 for CH_4, 310 for N_2O, 140 to 6,300 for HFCs, 6,500 to 9,200 for PFCs, and up to 23,900 for SF_6. To estimate the CO_2 equivalency of a non-CO_2 GHG, the appropriate GWP of that gas is multiplied by the amount of the gas emitted. All six GHGs are multiplied by their GWP and the results are added to calculate the total equivalent emissions of CO_2 (CO_2 Eq).

The dominant GHG gas emitted is CO_2, mostly from fossil fuel combustion (85.4%) (USEPA 2009c). Weighted by GWP, CH_4 is the second largest component of emissions, followed by N_2O. GWP-weighted emissions are presented in terms of equivalent emissions of CO_2, using units of teragrams (1 million metric tons or 1 billion kilograms) of carbon dioxide equivalents (Tg CO_2 Eq). The proposed action is anticipated to release GHGs to the atmosphere. These emissions are quantified and disclosed for each activity, in this Volume, in terms of CO_2. CO_2 emissions are similar for all alternatives examined in this Volume, as most project components that would affect potential air quality conditions remain the same for every alternative including the scale of construction, airfield operations, waterfront operations,

aviation training operations, and ground training. The CO_2 emissions for all components of the proposed action and alternatives are summarized in Volume 7, Section 3.3.4.

Since the change in climate conditions caused by the burning of fossil fuels is a global effect, requiring that the air quality impact analysis be assessed on a global or regional scale (i.e., not at the local scale such as for a city or an island), the cumulative impact is discussed in Volume 7, Section 4.4

5.1.2 North

Ambient air quality conditions around the northern region of Guam are affected by a combination of mobile sources including aircraft, aircraft ground support equipment, on-road and non-road vehicles, and construction equipment, and existing major stationary power plants located in the area. The population density in this area is higher compared to Apra Harbor area and southern regions of Guam.

5.1.2.1 Andersen Air Force Base (AFB)

Ambient air quality conditions around Andersen AFB are affected primarily by various operational activities occurring at the base and associated stationary and mobile emissions sources.

Stationary Sources

Andersen AFB is considered a major stationary source that requires a Title V operating permit. Andersen AFB is also classified as a major PSD source, based on the level of potential pollutants it may emit. The most recent 2007 actual stationary source emissions inventory is summarized in Table 5.1-2. The stationary source emissions include those from fuel tanks and fuel facilities.

Table 5.1-2. Andersen AFB – 2007 Actual Stationary Source Emissions

Total Emissions (TPY)					
SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*	*HAPs*
7.7	2.75	0.57	11.4	5.5	0.42

Note: Stationary sources include fuel tanks and fuel facilities.
Source: GEPA 2008.

Mobile Sources

Mobile source emissions are not considered in a Title V permit; however, they comprise a significant component of Andersen AFB's total emissions. Onsite mobile emission sources are aircraft, aircraft ground support equipment, and private- and government-owned on-road vehicles. The estimated mobile source emissions for the conditions existing in 2005 (most recent available data) are summarized in Table 5.1-3.

Table 5.1-3. Andersen AFB – 2005 Mobile Source Emissions

Total Emissions (TPY)					
SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*	*HAPs*
Aircraft and Ground Support Equipment					
260.8	79.5	16.8	72.6	22.8	0.0
On-Road Vehicles					
1.9	139.6	88.7	21.9	11.4	1.1
Combined Mobile Sources					
262.7	219.1	105.5	94.5	34.2	1.1

Source: PACAF 2006.

Given the temporary nature of construction equipment operations, construction-related mobile source emissions are not considered in the base-wide emissions inventory.

5.1.2.2 Finegayan

There are several on base housing parcels in Finegayan. Air quality conditions at Finegayan are affected predominantly by on-road mobile sources and aircraft operations around Andersen AFB, given limited exposure to other sources. At the Naval Computer and Telecommunication Station (NCTS), the Navy is currently permitted to operate three diesel emergency generators with a combined capacity of 7.5 megawatt (MW) and two 5.18 Million British Thermal Units (Btu) per hour boilers fired using No. 2 oil. Total permitted emissions for the sources at NCTS Finegayan are presented in Table 5.1-4.

Table 5.1-4. NCTS Finegayan—Permitted Emissions

Permitted Annual Emissions (TPY)				
SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*
106.9	43.0	5.9	187.4	5.5

Source: GEPA Title V Permit No. FO-15A.

5.1.2.3 Non-Department of Defense (DoD) Land

In addition to the on-road mobile sources and aircraft operations around Andersen AFB, several major stationary emission sources are located within non-DoD land areas owned by GPA as listed in Table 5.1-5. GPA operates the following three major power facilities in the North, each of which requires a Title V operating permit:

- Tanguisson: two steam boilers
- Marbo: one combustion turbine and one black start generator (internal energy source used to restore a power station to operation)
- Yigo: one combustion turbine and one black start generator (internal energy source used to restore a power station to operation)

Table 5.1-5. GPA Power Stations—Existing Permitted Major Source Emissions

Station Name	*Permitted Annual Emissions (TPY)*				
	SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*
Tanguisson (Unit #1 and #2)	8,795.0	236.5	391.1	1,927.2	10.9
Marbo	86.6	31.4	9.4	58.0	14.4
Yigo	272.2	49.8	42.9	133.3	9.0

Sources: GEPA Title V Permit Nos. FO-006, final dated May 11, 2009 (Marbo) ; FO-009, final dated May 11, 2009 (Yigo) ; and FO-012, draft April 17, 2009 (Tanguisson)
Note: VOC is based on UHC lb/hr limit (UHC- is unburned hydrocarbons). There is no specifically identified VOC lb/hr limit.

The Tanguisson power plant provides power for Guam. The Marbo facility is operated to alleviate load shedding on Guam during outages of other power-generating facilities. Load shedding is an almost instantaneous cutting of power to customers and is used only in extraordinary situations, such as losing a major generating station or a large power line. The Yigo facility is used for peaking and emergency operations.

Sensitive populations on non-DoD land in north Guam are mostly located along major traffic routes such as Routes 1 and 3.

5.1.2.4 Off Base Roadways

The proposed action includes on base roadway construction projects that would be implemented by the DoD. An affected environment description for on base roadway construction projects is included beneath the appropriate subheadings in other sections of this chapter. The following section describes the affected

environment for off base roadway construction projects that would be implemented by the Federal Highway Administration (FHWA).

The primary roadways in the north region include Routes 1, 3, 9, and 15. Because there are no air quality monitoring stations on Guam, existing pollutant levels in the north region are not available. The island of Guam is in attainment for all criteria pollutants, with the exception of SO_2, at two specific locations on the island. One nonattainment area encompasses the area within a 2.2-mi (3.5-km) radius of the Piti Power Plant. The second SO_2 nonattainment area encompasses the area within a 2.2-mi (3.5-km) radius of the Tanguisson Power Plant (see Figure 5.1-1).

5.1.3 Central

The central region of Guam has the greatest population concentration, and therefore a comparatively high number of on-road vehicles travel the main traffic routes through the area, affecting ambient air quality conditions. Military aircraft and training vehicle activities at Andersen South also generate emissions. This population is also exposed to emissions resulting from existing major stationary power plants located in the area.

5.1.3.1 Andersen South

Ambient air quality conditions around Andersen South are affected primarily by the operational activities of mobile sources at Andersen South, including on-road vehicles and aircraft. No sensitive population is present at Andersen South.

5.1.3.2 Barrigada

Ambient air quality conditions around Navy Barrigada and Air Force Barrigada are affected primarily by mobile source emissions associated with the military operations at the base and aircraft operations at Guam International Airport. There are no sensitive populations at Navy Barrigada or Air Force Barrigada.

5.1.3.3 Non-DoD Land and Naval Hospital Guam

In addition to the on-road mobile sources and aircraft operations around Andersen South and Guam International Airport, several major stationary emission sources are located on non-DoD land nearby. GPA operates the following four major power facilities in this region, each of which requires a Title V operating permit:

- Tenjo: six medium speed diesel generators
- Manengon: two diesel generators
- Macheche: one combustion turbine and one black start generator (internal energy source used to restore a power station to operation)
- Dededo: two combustion turbines, four diesel generators, and one black start generator (internal energy source used to restore a power station to operation)

The Tenjo, Manengon, and Macheche facilities provide electricity for Guam. The Dededo facility is operated to alleviate load shedding on Guam during outages of other power-generating facilities.

Power Source Energy Services operates diesel generators to provide electricity for the Agana Shopping Center, considered to be a major stationary source that requires a Title V operating permit. The permitted emissions for the Agana Shopping Center and the four GPA facilities are summarized in Table 5.1-6.

Table 5.1-6. Non-DoD Power Stations—Existing Permitted Major Source Emissions

Station Name	*Permitted Annual Emissions (TPY)*				
	SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*
Dededo	2,164.4	306.5	313.8	2,141.5	48.0
Tenjo	354.8	630.7	170.8	3,153.6	131.5
Manengon	54.2	76.0	5.1	170.0	8.1
Macheche	268.5	50.0	43.9	135.1	9.8
Agana Shopping Center	17.6	4.8	4.4	105.6	6.4

Source: GEPA Title V Permit Nos. FO-003, final dated May 11, 2009 (Dededo); FO-008, draft October 2008 (Tenjo); FO-005, draft October 2008 (Manengon); FO-004, final dated May 11, 2009 (Macheche); and FO-019, draft September 3, 2009 (Agana Shopping Center)

Sensitive populations on non-DoD land in central Guam are mostly located around the airport and along Tumon Bay and Agana Bay.

The Naval Hospital Guam operates three non-Title V permitted diesel-fuel–powered emergency generators (two 1 MW and one 75 kilowatt [kW]). The Naval Hospital facility is dedicated to support the hospital and does not provide capacity or supply to Guam. Also located at the Naval Hospital, but operated by Naval Facilities Engineering Command (NAVFAC) Marianas, are three 8.37 Million Btuper hour boilers fired with No. 2 oil and one 1.25 MW emergency diesel generator. Title V permitted annual emissions for NAVFAC Marianas – Hospital operating sources are summarized in Table 5.1-7. There are some sensitive populations along Route 1 in the Piti/Nimitz Hill area.

Table 5.1-7. Naval Hospital Guam—Title V Permitted Emissions

Permitted Annual Emissions (TPY)				
SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*
111.6	4.0	1.6	15.7	0.4

Source: GEPA Title V FO-015B

5.1.3.4 Off Base Roadways

The primary roadways in the central region include Routes 1 and 4. Because there are no air quality monitoring stations in the central region, existing pollutant levels are not available.

5.1.4 Apra Harbor

Ambient air quality conditions around Apra Harbor and Naval Base Guam are affected by a combination of on base mobile emission sources, including vessels and on-road vehicles, and major stationary power plants in the area. The population density in this area is relatively low as compared to central and north Guam. Commercial port transporting service air emissions were properly excluded from the general conformity analysis because they do not meet the indirect effects criteria (i.e., they are not reasonably foreseeable and cannot be practicably controlled by DoD as a part of their continuing program responsibility). Chapter 14, Marine Transportation includes a discussion of air emissions estimated from marine vessels at the Port of Guam.

5.1.4.1 Harbor

In addition to the mobile sources around Apra Harbor, there are several major stationary emission sources, including the GPA Cabras Power Plant in Piti Point area with two steam turbines and two slow speed diesel generators. In the same area, the Taiwan Electrical and Mechanical Engineering Services Power Plant operates a 40 MW combustion turbine known as Piti #7, and the Marianas Energy Company Power Plant operates two slow speed diesel generators, each rated at 44 MW (also known as Piti #8 and #9). Piti Power Plant also has two units #4 and #5 previously operated by GPA, but currently not in

operation. Table 5.1-8 provides permitted emissions for each plant. All of these major power facilities require a Title V operating permit.

Table 5.1-8. Non-DoD Power Stations—Existing Permitted Major Source Emissions

Station Name	*Permitted Annual Emissions (TPY)*				
	SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*
Cabras	17,577.5	1,140.6	1,364.0	12,341.8	877.8
Taiwan Electrical and Mechanical Engineering Services (Unit #7)	1,008.1	38.2	76.5	316.3	N/A
Marianas Energy Company (Units #8 and #9)	6,778.6	549.2	1,473.9	12,236.2	N/A

Sources: GEPA Title V Permit Nos. FO-002, final dated May 11, 2009 (Cabras). Taiwan Electrical and Mechanical Engineering Services (Unit #7) and Marianas Energy Company (Units #8 and #9) emissions levels listed are based on the emissions rates in grams per second shown in Tenjo Permit Application for the Taiwan Electrical and Mechanical Engineering Services (Unit #7) and Marianas Energy Company (both Units #8 and #9 combined) units assuming 8,760 operational hours per year. No information was available for VOC emission rates for Taiwan Electrical and Mechanical Engineering Services (Unit #7), and Marianas Energy Company (Units #8 and #9).

5.1.4.2 Naval Base Guam

Naval Base Guam has two emergency generators (one 100 kW and one 125 kW, respectively). Additionally, the Navy's Orote Point Power Plant has several air permits with combined permitted emissions exceeding 100 TPY for both NO_x and VOC. The sources covered by these separate air permits under the Orote Point Power Plant are as follows:

- Three 6.6 MW emergency diesel generators that can operate up to 1,350 hours per year combined for all three units, one 300 kW black start emergency generator, a 196,000 cubic yard (CY) (149,852.75 cubic meter [m^3]) sanitary landfill and shredder. Permitted emissions from these sources are included in a Title V permit and summarized in Table 5.1-9.
- One 10.5 MMBtu/hr boiler, one 6.3-Million Btuper hour boiler, and one 200 kW emergency generator.
- Various portable boilers and emergency diesel generators.

Table 5.1-9. Orote Point Power Plant Title V—Permitted Emissions

Permitted Annual Emissions (TPY)				
SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*
23.0	6.1	0.7	96.0	7.4

Source: GEPA Title V Permit No. FO-015F

5.1.4.3 Off Base Roadways

The primary roadways in Apra Harbor include Routes 1 and 2A. Because there are no air quality monitoring stations in Apra Harbor, existing pollutant levels are not available.

5.1.5 South

Compared with the other regions of Guam, the south has the lowest population density. Ambient air quality conditions are affected primarily by the comparatively few on-road vehicles traveling the main routes through the area. Military training activities at the Naval Munitions Site (NMS) also generate emissions, particularly PM emissions within the Annex. The population north of NMS is also exposed to emissions resulting from activities at Apra Harbor.

5.1.5.1 Naval Munitions Site

Military training activities at NMS generate emissions, in particular PM emissions within the Annex. There are no major stationary emission sources at NMS.

5.1.5.2 Off Base Roadways

The primary roadways in the south region include Routes 2 and 5. Because there are no air quality monitoring stations in the south region, existing pollutant levels are not available.

5.2 ENVIRONMENTAL CONSEQUENCES

Environmental consequences assessment performed and discussed in this section involves multiple air quality analyses, including: (1) an incremental emissions analysis of criteria pollutants and GHGs in terms of CO_2 emissions (total CO_2 equivalent compounds [CO_2Eq] emissions are summarized in Volume 7, Chapter 4 to assess overall impacts from the combined preferred alternatives) with the potential to emit from additional training activities, including aircraft, ships and vehicles; (2) an incremental emissions analysis of criteria pollutants and CO_2 with the potential to emit from construction equipment and hauling truck emissions during the construction period; and (3) a CAA general conformity applicability analysis for direct and indirect SO_2 emission increases that would result from the proposed action within the two SO_2 non-attainment areas shown in Figure 5.1-1. As discussed in Section 5.1.1.6, CO_2 is not a criteria pollutant and therefore is not compared to criteria pollutant thresholds. The potential effects of GHG emissions in terms of CO_2Eq are by nature global and are based on cumulative impacts and are discussed in Volume 7.

This description of environmental consequences addresses all components of the proposed action for the Marine Corps relocation to Guam. The components addressed include: Main Cantonment, Training, Airfield, and Waterfront. There are multiple alternatives for the Main Cantonment, Training-Firing Range, Training-Ammunition Storage, and Training-NMS Access Road. Airfield and Waterfront do not have alternatives. Although organized by the Main Cantonment alternatives, a full analysis of each alternative, Airfield, and Waterfront is presented beneath the respective headings. A summary of impacts specific to each alternative, Airfield, and Waterfront is presented at the end of this chapter. An analysis of the impacts associated with the off base roadways is discussed in Volume 6.

5.2.1 Approach to Analysis

5.2.1.1 Methodology

As described in Chapter 2, the proposed facilities associated with the relocation of Marine Corps units to Guam can be grouped together into one of four land use functions: Main Cantonment and Family Housing, Training, Airfield Operations, and Waterfront Operations. For the training function, the facilities can be further divided into three categories: firing ranges, non-fire maneuver ranges, and aviation training ranges. These proposed training facilities vary depending on the land use function, location, and quantity of non-DoD land to be acquired. Most project components that would affect potential air quality conditions remain the same for every alternative including:

- The scale of construction (Main Cantonment, Training Ranges, Waterfront)
- Airfield operations
- Waterfront operations
- Aviation training operations
- The scale of ground training

Therefore, although air emissions within each ROI would vary among the four Main Cantonment alternatives, predicted total air emissions (including CO_2) would remain the same for construction and operations among the four Main Cantonment alternatives, as well as the Training alternatives. The air emission sources associated with airfield, training, and waterfront operations can be characterized as mobile sources for which the criteria pollutant and CO_2 emissions are quantified. As some of the air quality effects from this action would have a combined effect in the ROI when added to the air quality effects of other proposed actions analyzed in this EIS, the analysis results presented here are also considered in the summary impacts analysis discussed in Volume 7, where applicable.

Construction Activities

The construction effort for all airfield, waterfront, and training alternatives is assumed to be the same, regardless of location. Therefore, the air emissions for these projects calculated for Alternative 1 are assumed to be representative of the other three alternatives (i.e., Alternatives 2, 3, and 8). Although the total building space does not vary by alternative for the main cantonment project component, the total size of earth disturbance under each alternative does vary. As a result, the pollutant emissions associated with the main cantonment construction activity were estimated individually for each alternative.

Construction activities, including the operation of construction equipment, trucks, and workers' commuting vehicles, may have short-term air quality impacts. In estimating construction-related criteria pollutants and CO_2 emissions, the usage of equipment, the likely duration of each activity, and manpower estimates for the construction were based on the information described in Chapter 2 for future project-associated construction activities.

Estimates of construction crew and equipment requirements and productivity were based on the data contained in 2003 *RSMeans Facilities Construction Cost Data* (RSMeans 2003) and 2006 *RSMeans Heavy Construction Cost Data* (RSMeans 2006). It is assumed for the emissions estimate purposes that major construction activities would start from 2011 through 2014 with minimal effort during 2010 for all projects. The construction of the Main Cantonment is assumed to occur from 2011 to 2016 based on the construction cost profile projected for the proposed action.

Estimates of construction equipment operational emissions were based on estimated hours of equipment use and the emission factors for each type of equipment, as provided by USEPA using the NONROAD emission factor model (USEPA 2008). National default model inputs for non-road engines, equipment, and vehicles of interest were also provided in the USEPA model (USEPA 2008), as were average equipment horsepower values and equipment power load factors.

A maximum sulfur content of 0.5% was used based on USEPA's Heavy-Duty Standards/Diesel Fuel Regulatory Impact Analysis (RIA) (USEPA 2000). Based on the RIA, data observed in 1992 shows that No. 2 diesel fuel imports actually had sulfur content ranging from 0.39% to 0.5%. Therefore, using the actual highest sulfur content observed in 1992 (0.5%) for vehicles in this analysis is considered appropriate and conservative and is also coincident with the highest sulfur content fuel input available in the NONROAD model. It should also be noted that with the introduction of the Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements (40 CFR Parts 69, 80, and 86) in 2006, refiners were required to start producing diesel fuel for use in highway vehicles with a sulfur content of no more than 15 ppm (i.e., 0.0015% content). Therefore, the sulfur content of fuels since 1992 has decreased in general although Guam has been granted an exemption from using low sulfur fuel (see Volume 6, Section 7.2). DoD is currently examining the potential use of ultra low sulfur fuel for construction activities and highway diesel vehicles on Guam, so that the actual sulfur content may be far lower than the level used in the analysis.

Since the operational activity data presented in RSMeans' cost data books are generated based on the overall length of equipment on site, an equipment actual running time factor (i.e., actual usage factor) was further employed to determine actual usage hours for the purpose of estimating equipment emissions. The usage factor for each equipment type was obtained from Federal Highway Administration's Roadway Construction Noise Model User's Guide (FHWA 2006). Emission factors related to construction-associated delivery trucks were estimated using the USEPA Mobile6 emission factor model (USEPA 2003), that provides a specific emission factor data base for various truck classifications. Similar to the construction equipment emissions estimate described above, the highest sulfur content (0.5%) fuel input available in the Mobile6 model, which is also the highest sulfur content observed in the RIA (USEPA 2000), was conservatively used to predict both SO_2 and PM emissions from diesel-powered vehicles. The crew's commuting vehicle emissions were estimated using the same Mobile6 model and assumed workers would travel approximately an average of 10 mi (16 km) per day to the site using shuttle buses or vans.

The detailed methodology used to calculate these emissions is presented in Volume 9, Appendix I, Section 3.4, Construction Activity Emissions.

Operational Activities

Stationary sources that would be installed to run completed airfield, waterfront, training, and main cantonment facilities include furnaces, boilers, hot water heaters, and air conditioning systems, where applicable. These appliances would likely be powered by electricity generated by the new or upgraded existing power system on Guam. Therefore, potential air quality impacts from stationary source operational emissions are addressed in Volume 6 in the Utility Resources impact section.

Mobile source operational activities are part of each of the four alternatives. Operational elements that have potential to impact air quality include:

- Aircraft flight training operations at Andersen AFB, Northwest Field, Orote Airfield, Andersen South Airfield, and NMS
- Waterfront ship operations
- Ground vehicle operations at various ranges
- The emissions from aircraft landing and taking off at Andersen AFB and from various pattern training flights at Andersen AFB and other airfields were estimated using the methods and emission factors obtained from the following references:
- The Procedures of Emission Inventory Preparation, Volume IV: Mobile Sources (USEPA 1992)
- Aircraft engine emission factors developed by the Navy's Aircraft Environmental Support Office (AESO 1999–2001)
- U.S Air Force Air Conformity Applicability Model (Version 4.3) (Air Force Center for Engineering and the Environment 2005)
- Aircraft Noise Study for Guam Joint Military Master Plan at Andersen AFB (Czech and Kester 2008)
- The training flight sorties and flight hours defined around each airfield were based on information described in Chapter 2.3.1.5 of this Volume.

The emissions from training ships were calculated for criteria pollutants using average power level correlated emission factors established for each naval vessel type and provided in Southern California Range Complex EIS/Overseas Environmental Impact Statement (OEIS) (Navy 2008). Tugboat emissions were calculated using emission factors, load factors, and power values related to diesel marine vessels

obtained from Current Methodologies and Best Practices in Preparing Port Emission Inventories (USEPA 2006). Emission factors were multiplied by the estimated running hours for each training ship to predict annual total ship emissions within applicable ROIs. For greenhouse gas emissions in terms of CO_2 emissions, the emissions with potential to result from ship operations were estimated based on emission factors provided by the California Air Resources Board (CARB) (CARB, 2008). The emission factors were provided in kilogram of CO_2 per gallon fuel consumed, Therefore fuel consumption for each ship was estimated first based on individual vessel's rated horsepower associated with each propulsion system type. Propulsion types include boilers used in the Amphibious Assault Ship and diesel engines used in all other vessels. The fuel consumption in gallons per hour predicted for each ship was then multiplied by the emission factors to get the emission rate in pounds per hour.

Ground training vehicle exhaust emissions from trucks, high mobility multipurpose wheeled vehicles, and buses during training exercises were estimated with the same method used to predict construction vehicle emissions. The USEPA Mobile6 emission factor model (USEPA 2003) was used to predict emissions factors associated with each type of training vehicle defined based on the average weight and fuel type. The emission factors were then multiplied by the annual vehicle running hours for each type of vehicle during the training periods within specific ROIs. Moreover, since majority of these training vehicles would maneuver on unpaved roads with potential to generate a great amount of fugitive dust, USEPA AP-42 was used to predict additional unpaved road fugitive dust emissions from training vehicles.

On base vehicle exhaust emissions from commuting vehicles and trucks during daily on base operations were estimated based on the forecasted daily trips through each main gate and average traveling distance at each base within specific ROIs in a similar way used for predicting ground training vehicle emissions.

The detailed methodology used to calculate these emissions is presented in Volume 9, Appendix I, Section 3.3.6, On Base Vehicle Operational Emissions.

5.2.1.2 Determination of Significance

Under CAA, aircraft, ships, motor vehicles, and construction equipment are exempt from air permitting requirements. Since the emissions from these sources associated with the proposed action and alternatives would occur in areas that are in attainment of the NAAQS for all criteria pollutants, with the exception of the two nonattainment areas for SO_2 that are handled separately in the analyses (see discussion under north Guam and Central in the subsequent sections), the GCR is not applicable. Nonetheless, the National Environmental Policy Act (NEPA) and its implementing regulations require analysis of the significance of air quality impacts from these sources as well as non-major stationary sources. However, neither NEPA nor its implementing regulations have established criteria for determining the significance of air quality impacts from such sources in CAA attainment areas.

In the GCR applicable to non-attainment areas, USEPA uses the "major stationary source" definition under the NSR program as the *de minimis* levels to separate presumably exempt actions from those requiring a positive conformity determination. Since the proposed action and alternatives would occur mostly in areas that have always been in attainment, the EIS selected the "major stationary source" definition (250 TPY or more of any air pollutant subject to regulations under the CAA) from the PSD program. The PSD is used as the criteria for locations that are in attainment for determining the potential significance of air quality impacts from these sources.

As noted above, neither the PSD permitting program or the GCR are applicable to these mobile sources and minor (i.e., non-major) stationary sources in attainment areas. Therefore, the analysis of construction and operational incremental emissions from these sources in attainment areas and the significance criteria

selected (250 TPY) are solely for the purpose of informing the public and decision makers about the relative air quality impacts from the proposed action and alternatives under NEPA requirements. However, since the 250 TPY threshold is selected in the context of the *de minimis* threshold established in the GCR, which provides only an indication of potential significant impact, a formal concentration impact analysis should be conducted, where appropriate. For example, CO is a localized pollutant; if the 250 TPY threshold is exceeded for CO, a subsequent dispersion modeling for major emission contributing sources is conducted to further evaluate potential impact significance with respect to the NAAQS.

Some areas on Guam fall within one of the two SO_2 nonattainment areas. Under the GCR, both direct and indirect emissions associated with all operational and construction activities from a proposed federal action must be quantified and compared to annual *de minimis* (threshold) levels for pollutants that occur within the applicable nonattainment area. Direct emissions are emissions of a criteria pollutant or its precursors that are caused or initiated by a federal action and occur at the same time and place as the action. Indirect emissions are emissions occurring later in time and/or further removed in distance from the action itself. Indirect emissions must be included in the determination, if both of the following apply:

- The federal agency proposing the action can practicably control the emissions and has continuing program responsibility to maintain control and the emissions caused by the federal action are reasonably foreseeable. Given the nature of the proposed action, foreseeable emissions that the Navy can practicably control are limited to emissions resulting from on-site operational and construction activities.
- The SO_2 emissions estimated for the activities associated with the proposed action from both stationary and mobile sources within two SO_2 nonattainment areas were compared with the 100 TPY *de minimis* level to determine impact significance for SO_2 emission increase.

Both of these situations apply, and therefore indirect emissions were included in the determination. It should be noted that the above thresholds established for emissions comparison purposes are required to be used for all relevant emissions from the proposed action. The emissions quantification described in this section is only for disclosure purposes to evaluate individual action component air quality impact using the same thresholds. The overall air quality impacts, including the general conformity applicability requirements, are discussed in Volume 7, which addresses the combined effects from all project components under the proposed actions and presents a summary of the effects.

5.2.1.3 Issues Identified during Public Scoping Process

The following analyses focus on addressing potential air quality impacts within each ROI from implementing the proposed action and alternatives. As part of the analysis, concerns relating to air quality effects that were raised by the public, including regulatory stakeholders, during the scoping process were addressed. These include:

- Increases in vehicle and vessel emissions and disclosure of available information of health risks associated with vehicle emissions and other mobile source emissions
- Increases in construction-related emissions and impacts including emissions estimates of criteria pollutants and diesel PM from construction of alternatives
- Compliance with the GCR in siting project facilities.

5.2.2 Alternative 1

For the purpose of this evaluation, the construction effort for all airfield, waterfront, training facilities is assumed to be the same, regardless of location. Therefore, the estimate of air emissions calculated for

Alternative 1 presented here for these facilities is assumed to be representative of the three other alternatives (Alternatives 2, 3, and 8). However, given the slightly different scale of main cantonment construction under each alternative, an estimate of air emissions associated with main cantonment construction was performed for each alternative. The operational components of all four action alternatives are considered to be the same (see Sections 2.3 through 2.5 in this Volume), and therefore predicted operational emissions for Alternative 1 are also applicable to Alternatives 2, 3, and 8.

5.2.2.1 North

Andersen AFB

Construction

Additional runway and hangar space, as well as maintenance and administrative facilities for airfield operations, are planned for Andersen AFB. New air embarkation operations that are comparable to the existing Andersen AFB embarkation operations are planned under the proposed action. The construction activity estimate utilizes the airfield and vehicle pavement "prototype" elements provided in RSMeans 2003 handbook (RSMeans 2003) to provide data associated with airfield construction at Andersen AFB. The total construction emissions produced from potential construction equipment, and vehicle and paving activities occurring from 2011–2014 that are associated with airfield operations facilities construction are provided in Table 5.2-1. The proposed training facilities for airfield operations include the construction of new earth-covered magazine structures for the storage of ordnance and the construction of administrative areas. The air emissions from construction of airfield training facilities are also included in Table 5.2-1 and detailed in Volume 9, Appendix I, Section 3.4 Construction Emissions: Marine Corps Relocation – Guam. The air emissions from the construction of main cantonment facilities are presented in Table 5.2-2 and detailed in Volume 9, Appendix I, Section 3.4 Construction Emissions: Marine Corps Relocation – Guam.

Table 5.2-1. Training Field and Facility Annual Construction Emissions (2011-2014)

ROI	*Construction Activity*	*Total Annual Pollutant Emissions (TPY)*						
		SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
North	Andersen AFB Airfield Operations	0.5	1.5	0.1	0.1	1.0	2.5	166.0
	Training Facilities (Volume 2)	0.0	0.1	0.0	0.0	0.0	0.0	7.4
	C3 and Non-Firing Training Facilities	0.2	0.6	0.0	0.0	0.3	0.9	49.3
Sub Total		**0.7**	**2.2**	**0.1**	**0.1**	**1.3**	**3.4**	**222.7**
Central	C3 and Non-Firing Training Facilities	0.2	0.6	0.0	0.0	0.3	0.9	49.3
	Firing Training, Alternative A	0.4	1.6	0.1	0.1	1.0	0.5	138.9
	Firing Training, Alternative B	0.8	1.7	0.2	0.2	1.5	0.3	264.3
Sub Total		**1.4**	**3.9**	**0.3**	**0.3**	**2.8**	**1.7**	**452.5**
Apra Harbor	Waterfront Operations	1.1	0.8	0.0	0.0	0.5	0.4	80.1
South	Training Facilities	0.0	0.1	0.0	0.0	0.0	0.0	7.4

Table 5.2-2. Main Cantonment Annual Construction Emissions (2011-2016)

	Construction Activity	*Pollutant*						
	Total Annual Emissions (TPY)	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
Alternative 1, North	2011 (11%)	6.3	25.8	1.5	1.4	13.1	10.2	2,160.6
	2012 (18%)	10.3	42.2	2.4	2.3	21.4	16.6	3,535.5
	2013 (23%)	13.1	53.9	3.1	2.9	27.3	21.3	4,517.6
	2014 (23%)	13.1	53.9	3.1	2.9	27.3	21.3	4,517.6
	2015 (17%)	9.7	39.8	2.3	2.2	20.2	15.7	3,339.1
	2016 (8%)	4.6	18.8	1.1	1.0	9.5	7.4	1,571.3
Alternative 2, North	2011 (11%)	6.4	26.2	1.5	1.4	13.3	10.4	2,188.9
	2012 (18%)	10.4	42.9	2.5	2.3	21.7	16.9	3,581.9
	2013 (23%)	13.3	54.8	3.2	3.0	27.7	21.6	4,576.8
	2014 (23%)	13.3	54.8	3.2	3.0	27.7	21.6	4,576.8
	2015 (17%)	9.9	40.5	2.3	2.2	20.5	16.0	3,382.9
	2016 (8%)	4.6	19.1	1.1	1.0	9.6	7.5	1,591.9
Alternative 3, North	2011 (11%)	4.3	17.6	1.0	1.0	8.9	6.9	1,461.4
	2012 (18%)	7.0	28.8	1.7	1.6	14.5	11.4	2,391.3
	2013 (23%)	8.9	36.7	2.1	2.0	18.5	14.5	3,055.6
	2014 (23%)	8.9	36.7	2.1	2.0	18.5	14.5	3,055.6
	2015 (17%)	6.6	27.2	1.6	1.5	13.7	10.7	2,258.5
	2016 (8%)	3.1	12.8	0.7	0.7	6.5	5.0	1,062.8
Alternative 3, Central	2011 (11%)	2.3	9.3	0.5	0.5	4.7	3.7	776.6
	2012 (18%)	3.7	15.3	0.9	0.8	7.7	6.0	1,270.7
	2013 (23%)	4.7	19.5	1.1	1.1	9.9	7.7	1,623.7
	2014 (23%)	4.7	19.5	1.1	1.1	9.9	7.7	1,623.7
	2015 (17%)	3.5	14.4	0.8	0.8	7.3	5.7	1,200.1
	2016 (8%)	1.6	6.8	0.4	0.4	3.4	2.7	564.8
Alternative 8, North	2011 (11%)	5.2	21.3	1.2	1.2	10.7	8.4	1,769.0
	2012 (18%)	8.4	34.8	2.0	1.9	17.6	13.8	2,894.8
	2013 (23%)	10.8	44.5	2.6	2.4	22.4	17.6	3,698.9
	2014 (23%)	10.8	44.5	2.6	2.4	22.4	17.6	3,698.9
	2015 (17%)	8.0	32.9	1.9	1.8	16.6	13.0	2,734.0
	2016 (8%)	3.7	15.5	0.9	0.8	7.8	6.1	1,286.6
Alternative 8, Central	2011 (11%)	1.2	5.2	0.3	0.3	2.6	2.0	428.5
	2012 (18%)	2.0	8.4	0.5	0.5	4.3	3.3	701.2
	2013 (23%)	2.6	10.8	0.6	0.6	5.4	4.3	896.0
	2014 (23%)	2.6	10.8	0.6	0.6	5.4	4.3	896.0
	2015 (17%)	1.9	8.0	0.5	0.4	4.0	3.1	662.3
	2016 (8%)	0.9	3.7	0.2	0.2	1.9	1.5	311.7

Operation

Aircraft and helicopter engines emit criteria pollutants during all phases of operation whether climb out, approach, touch and go, ground control approach box, or cruise. Based on the estimated number of additional sorties on an annual basis (Czech and Kester 2008) and on base maintenance for the addition of new aircraft at Andersen AFB North Ramp field, the annual aircraft operational emissions were estimated using the emission factors provided by Aircraft Environmental Support Office. The aircraft sortie emissions estimates are summarized in Table 5.2-3 and the detailed methodology used for the estimates is presented in Volume 9, Appendix I, Section 3.3 Aircraft Operational Emissions.

Table 5.2-3. Annual Increase in Aircraft Sortie Emissions at Andersen AFB

Activity	*Pollutant (TPY)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Aircraft Carrier Airwings	0.4	91.6	4.7	4.7	8.6	26.6	NA
Based Aircraft LTO, touch and go, FCLP and ground control approach box	1.8	106.1	17.1	17.1	33.3	35.6	3,219.1
Based Aircraft Maintenance	0.4	29.7	3.5	3.5	6.8	10.2	1,258.0
Total Operation	2.6	227.4	25.3	25.3	48.7	72.4	4,477.1

Note: CO_2 emissions are only available for MV-22 aircraft.

Aircraft flight emissions during training exercises below 3,000 ft (914 m) altitude within Andersen AFB airspace were also estimated based on the flight training forecasts provided earlier in this Volume (Section 2.3). The aircraft training emissions are summarized in Table 5.2-4 and detailed in Volume 9, Appendix I, Section 3.3 Aircraft Training Emissions.

Table 5.2-4. Aircraft Training Flight Annual Emissions

Location	*Pollutant (TPY)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	CO_2
North							
Northwest Field	0.1	0.5	0.4	0.4	2.4	0.1	428.8
Andersen AFB	0.1	1.1	0.6	0.6	3.2	0.3	339.8
Sub Total	0.2	1.6	1.0	1.0	5.6	0.4	768.6
Central							
Andersen South	0.1	0.5	0.5	0.5	1.9	0.1	107.4
Apra Harbor							
Orote	0.1	0.4	0.4	0.4	2.0	0.1	361.0
South							
NMS	0.3	1.4	1.8	1.8	10.6	0.1	1869.5

Note: CO_2 emissions are only available for MV-22, CH-46, and C-130 aircraft.

On base annual commuting vehicle emissions within Andersen AFB were estimated using the methodology described in Section 5.2.1.1 and are summarized in Table 5.2-5 and detailed in Volume 9, Appendix I, Sections 3.3 Training Vehicles Emissions and On Base Vehicle Operational Emissions.

Table 5.2-5. Vehicle Annual Emissions

Location	*Pollutant (TPY)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	CO_2
Training Vehicle Emissions							
Central							
Andersen South	0.1	0.7	10.1	1.0	0.1	0.1	80.8
Guam Range Complex	0.1	0.9	14.0	1.4	0.1	0.1	64.7
Troop Transport	0.1	0.0	0.0	0.0	0.1	0.0	16.2
Sub Total	**0.2**	**1.6**	**24.1**	**2.4**	**0.3**	**0.2**	**161.8**
South							
NMS	0.0	0.0	0.5	0.1	0.0	0.0	2.3
On Base Commuting Vehicle Emissions							
North							
Finegayan	8.2	207.3	1.6	1.0	9.9	13.1	17,316.5
Andersen AFB	1.9	46.9	0.4	0.2	2.2	3.0	3,919.3
Sub Total	**10.1**	**254.2**	**1.9**	**1.2**	**12.2**	**16.1**	**21,235.8**
Central							
Andersen South	0.5	12.8	0.1	0.1	0.6	0.8	1,068.1
Barrigada	2.3	58.1	0.4	0.3	2.8	3.7	4,858.1
Sub Total	**2.8**	**70.9**	**0.5**	**0.3**	**3.4**	**4.5**	**5,926.1**
Apra Harbor							
Naval Base & Polaris Point	0.3	8.6	0.1	0.0	0.4	0.5	716.3
South							
NMS	0.1	0.8	0.0	0.0	0.0	0.1	77.6

Finegayan

Construction

In Finegayan, potential construction of the main cantonment would include bachelor housing, supply warehouses, maintenance facilities, various headquarters and administrative support facilities, community support facilities, some training areas, and open space. In order to streamline development of a construction estimate for the main cantonment, each individual item was assigned to one of 12 types of "prototype" elements, with complete construction estimates developed for a representative sample of each of these prototypes. The prototype elements include:

- Office
- Commercial
- Pre-Engineered Structures
- Industrial
- Hangar
- Warehouse
- Residential (Multiple Unit)
- Residential (Single-family Units)
- Site Preparation
- Utility and Road/Sidewalk Installation
- Vehicle pavement
- Aircraft pavement

The total air emissions resulting from potential construction equipment, vehicle, and paving activities occurring between 2011 and 2016 are summarized in Table 5.2-1 and air emissions from the construction of main cantonment facilities are presented in Table 5.2-2.

In addition to the main cantonment, command, control and communications (C3) and non-firing training facilities are also planned for the north in Finegayan as part of the Guam Military Relocation. The construction estimate for C3 and non-firing training assigns "prototype" elements, and also includes additional specific items, when needed, in the estimate. The prototype elements for C3 include:

- Battle Staff Training and Simulation
- Marine Air Ground Task Force Integrated Systems Training Center
- Combined Arms Staff Training

The prototype elements for non-firing training include:

- Obstacle Course, Confidence Course
- Hand-to-Hand Combat Pit
- Rappelling Tower
- Gas Chamber
- Combat Training Tank
- General Purpose Auditorium
- The Crew, Unit and Military Occupational Specialty Combat Skills elements

The total air emissions resulting from potential construction equipment, vehicle and paving activities occurring between 2011 to 2014 for C3 and non-firing training facilities in the north are shown in Table 5.2-1.

Operation

On base annual commuting vehicle emissions within Finegayan were estimated using the methodology described in Section 5.2. Other operational air emission estimates are considered with utility services and roadway development (see Volume 6).

Non-DoD Land

Construction

Non-DoD land would be a part of the Main Cantonment as described in Chapter 2, and therefore construction and operation emissions were not calculated separately for this area. Table 5.2-2 provides construction emissions for the Main Cantonment.

Operation

Tables 5.2-4 and 5.2-5 provide operation emissions for north Guam.

The construction emissions and aircraft operational and flight emissions for north Guam shown in Tables 5.2-1 to 5.2-4 are all below the significance criteria of 250 TPY for air pollutants, except for CO. The SO_2 emissions were also all below the 100 TPY *de minimis* level that is applicable to the Tanguisson nonattainment area. The CO annual emissions would exceed 250 TPY threshold primarily due to commuting vehicles traveling on base. As described in Section 5.2, an evaluation is warranted to further determine whether these site-specific vehicular CO emissions would result a potential exceedance of the CO NAAQS. The modeling analysis and associated results are described in Volume 6 for roadway

projects and no exceedances of CO NAAQS are predicted. Therefore, the potential CO impact is not considered significant, although the 250 TPY threshold is exceeded in north Guam.

5.2.2.2 Central

Andersen South

Construction

Live-fire training range facilities are proposed for east of Andersen South at Route 15. The construction estimate used for live-fire training range elements utilizes the following prototypes:

- Overall site preparation – included for both Alternatives A and B.
- Range Control and Maintenance Facilities.

The total air emissions resulting from potential construction equipment, vehicle and paving activities occurring from 2011 to 2014 for live-fire training facilities are shown in Table 5.2-1.

Operation

Aircraft flight operational emissions during training exercises within Andersen South airspace were also estimated based on the training forecasts described in Section 2.3. These emissions are summarized in Table 5.2-4.

Annual vehicle emissions during training exercises and on base commuting operations within Andersen South were estimated based on the training forecasts described in Section 2.3 and using the methodology described in Section 5.2.1.1.

Barrigada

Construction

No new construction is proposed in Navy Barrigada or Air Force Barrigada, and therefore no construction emissions are predicted for this area.

Operation

On base annual commuting vehicle emissions within Barrigada were estimated using the methodology described in Section 5.2.1.1. No other new operations are proposed in Navy Barrigada or Air Force Barrigada.

The construction emissions, aircraft operational and flight emissions, and vehicle emissions for Central shown in Tables 5.2-1, 5.2-4, and 5.2-5 are all below the significance criteria of 250 TPY for air pollutants subject to regulations under the CAA, as described in Section 5.2. The predicted SO_2 emissions are also below the 100 TPY *de minimis* level within the Piti and Tanguisson nonattainment areas.

Non-DoD Land

Construction

The only construction on non-DoD land is on the Route 15 Parcel. However, the roadway construction-related impact is discussed in Volume 6, Chapter 7.

Operation

Annual vehicle emissions during training exercises within other areas in central Guam were estimated and are summarized in Table 5.2-5.

5.2.2.3 Apra Harbor

Harbor

Construction

The construction of facilities planned for the proposed waterfront operations at Apra Harbor include ship berthing and embarkation, Landing Craft Air Cushion/Amphibious Assault Vehicle laydown area, U.S. Coast Guard (USCG) relocation, military working dog kennel relocation, and a medical clinic. In addition to using construction elements similar to the prototype buildings previously discussed, specialty construction works associated with the waterfront construction elements are also considered, as listed below:

- Victor/Uniform Wharf
- Sierra/Tango Wharves
- Southwest of Victor Wharf
- Adjacent to Victor Wharf
- Landing Craft Air Cushion/ Amphibious Assault Vehicle
- USCG Relocation
- Military Working Dog Kennel
- Medical Clinic

The total air emissions resulting from potential construction, vehicle and paving activities associated with the construction of waterfront facilities that would occur from 2011 to 2014 in the Apra Harbor are summarized in Table 5.2-1.

Operation

Aircraft flight operational emissions during the training exercises around Orote Airfield were also estimated based on the training forecasts described in Section 2.3. These emissions are summarized in Table 5.2-4.

The annual vessel emissions during the training exercises around Apra Harbor were estimated based on the vessel travel distance and speed forecasted and the methodology discussed in Section 5.2. These emissions are summarized in Table 5.2-6 and detailed in Volume 9, Appendix I, Section 3.3.4 Marine Vessel Training Emissions.

Table 5.2-6. Training Vessel Annual Emissions

Type	*Pollutant (TPY)*						
	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
Ships Carrying Amphibious Vehicles	0.4	0.0	0.1	0.1	0.1	0.0	886.2
Amphibious Vehicles	2.8	2.8	6.2	6.2	4.8	0.4	324.7
Escort Combat Ships	0.2	0.9	0.0	0.0	0.4	0.1	182.9
Barges	0.2	0.8	0.1	0.1	4.2	0.1	29.3
Total	3.6	4.5	6.4	6.4	9.5	0.6	1423.1

Naval Base Guam

Construction

Construction proposed in the Naval Base Guam area is discussed in the previous section (Harbor).

Operation

Annual commuting vehicle emissions within the base were estimated using the methodology described in Section 5.2. and are summarized in Table 5.2-4. The construction emissions, aircraft operational and flight emissions, on base commuting vehicle emissions, and vessel emissions for Apra Harbor shown in Tables 5.2-1, 5.2-4, and 5.2-6 are all below the significance criteria of 250 TPY for air pollutants subject to regulations under the CAA, as described in Section 5.2. The predicted SO_2 emissions are also below the 100 TPY *de minimis* level within the Piti nonattainment areas.

5.2.2.4 South

Naval Munitions Site

Construction

Additional airfield training is proposed at NMS in south Guam. As described above in Section 5.2.2.1, proposed training facilities include the construction of new earth-covered magazine structures for the storage of ordnance and the construction of administrative areas. The total air emissions resulting from potential construction equipment, vehicle and paving activities occurring from 2011 to 2014 for airfield training facilities in the south are summarized in Table 5.2-1.

Operation

Aircraft flight operational emissions during the training exercises around NMS airfield were also estimated based on the training forecasts described in Section 2.3. These emissions are summarized in Table 5.2-4.

Annual vehicle emissions during training exercises within NMS were estimated based on the training forecasts described in Sections 2.3 and using the methodology described in Section 5.2. and are summarized in Table 5.2-5. Annual commuting vehicle emissions within NMS were estimated using the methodology described in Section 5.2. and are summarized in Table 5.2-5

The construction emissions, aircraft operational and flight emissions, and vehicle emissions for south Guam shown in Tables 5.2-1, 5.2-4, and 5.2-5 are all below the significance criteria of 250 TPY for air pollutants subject to regulations under the CAA, as described in Section 5.2.

5.2.2.5 Summary of Impacts

Air emissions associated with both construction and operational components of Alternative 1 would be well below the significance criteria of 250 TPY for all air pollutants except CO. However, a further CO dispersion modeling analysis described in Volume 6 shows that no exceedances of CO NAAQS would occur from roadway traffic under the proposed action. Therefore, the potential CO impact is not considered significant although the 250 TPY threshold is exceeded. The predicted SO_2 emissions would be below the 100 TPY *de minimis* level within the two nonattainment areas. Therefore, all project specific air quality impacts are considered less than significant for all areas for this action.

5.2.2.6 Proposed Mitigation Measures

The predicted construction emissions (2011 to 2016) and operational emissions (2015 and after) for criteria pollutants within each ROI are all below the 250 TPY threshold or 100 TPY SO_2 threshold applicable for SO_2 nonattainment areas. Therefore potential air quality impacts under Alternative 1 are considered less than significant and emissions mitigation measures are not warranted.

5.2.3 Alternative 2 (Preferred Alternative)

The construction effort for all airfield, waterfront, and training projects is assumed to be essentially the same for Alternative 2 as for Alternative 1, as well as air emissions associated with operational components. The construction emissions associated with main cantonment facilities under Alternative 2 were calculated separately due to a slight difference in earth disturbance as compared to Alternative 1.

5.2.3.1 North

Andersen AFB

Construction

Emissions that result from the proposed installation of airfield operations facilities and aviation training at Andersen AFB for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-1. As discussed in Section 5.2.1, the majority of project components that would affect potential air quality conditions remain the same for each alternative and therefore the total predicted construction emissions are the same for all alternatives.

Operation

Annual aircraft and on base vehicle operational emissions for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2. and presented in Tables 5.2-3, 5.2-4, and 5.2-5.

Finegayan

Construction

Construction emissions resulting from the proposed main cantonment facilities were estimated using the same methodologies and procedures described in Sections 5.2.1.1 and 5.2.2.1 and are summarized in Table 5.2-2. The training facilities at Finegayan for C3 and non-firing training facilities as planned in Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-1.

Operation

Annual on base vehicle operational emissions for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

Non-DoD Land

Construction

Non-DoD land would be a part of the main cantonment as described in Chapter 2, and therefore construction and operation emissions were not calculated separately for this area. Construction emissions for the main cantonment for Alternative 2 are provided in Table 5.2-2.

Operation

Table 5.2-4 provides operation emissions for North, which is considered to be the same as for Alternative 1.

5.2.3.2 Central

Andersen South

Construction

Construction emissions that result from the proposed installation of training facilities for C3, non-firing training, and live-fire training in central Guam near Andersen South for Alternative 2 are assumed to be the same as those for Alternative 1, which are discussed above and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during training exercises within Andersen South airspace and on base commuting vehicle emissions within Andersen South for Alternative 2 are assumed to be the same as those for Alternative 1, which are discussed in Section 5.2.2.2 and presented in Tables 5.2-3, 5.2-4 and 5.2-5.

Barrigada

Construction

Under Alternative 2, the placement of administration and maintenance facilities and housing is proposed within Navy Barrigada. No new activities would occur at Air Force Barrigada. As construction activity is assumed to be similar to Alternative 1, the same annual emissions during construction years are predicted under Alternative 2. These emissions are discussed in Section 5.2.2.1 and presented in Table 5.2-1.

Operation

Annual on base vehicle operational emissions for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

Non-DoD Land

Construction

There would be no construction on non-DoD land in central Guam, as the area proposed for DoD use is limited to the Route 15 Parcel.

Operation

Annual vehicle emissions during training exercises within other areas in central Guam for Alternative 2 are assumed to be the same as those for Alternative 1 and are summarized in Table 5.2-5.

5.2.3.3 Apra Harbor

Harbor

Construction

Emissions that result from the proposed installation of waterfront operations facilities at Apra Harbor for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.3 and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during the training exercises around Orote Airfield Harbor for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.3 and presented in Table 5.2-4.

Naval Base Guam

Construction

Construction proposed in the Naval Base Guam area is discussed in the previous section (Harbor).

Operation

Annual on base vehicle operational emissions for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

5.2.3.4 South

Naval Munitions Site

Construction

Emissions that result from the proposed construction of aviation training facilities and non-firing ranges at the NMS for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.4 and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during the training exercises and on base commuting vehicle emissions around NMS for Alternative 2 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.4 and presented in Tables 5.2-4 and 5.2-5.

5.2.3.5 Summary of Impacts

All air emissions would be well below the significance criteria of 250 TPY for all air pollutants except for CO. However, a further CO dispersion modeling analysis described in Volume 6 shows that no exceedances of CO NAAQS would occur from roadway traffic under the proposed action. Therefore, the potential CO impact is not considered significant although the 250 TPY threshold is exceeded. The predicted SO_2 emissions would below the 100 TPY *de minimis* level within the two nonattainment areas. Therefore, all project specific air quality impacts are considered less than significant for all areas for this action. The overall air quality impacts are discussed in Volume 7, which addresses the combined effects from all project components under the proposed actions.

5.2.3.6 Proposed Mitigation Measures

The overall construction emissions are anticipated to be slightly higher as compared to Alternative 1 because of slightly more earth disturbance associated with the main cantonment construction, but the predicted construction emissions (2011 to 2016) and operational emissions (2015 and after) for criteria pollutants within each ROI are all below the 250 TPY threshold or 100 TPY SO_2 threshold applicable for SO_2 nonattainment areas. Therefore, potential air quality impacts under Alternative 2 are considered less than significant and emissions mitigation measures are not warranted.

5.2.4 Alternative 3

This alternative includes construction at NCTS Finegayan with portions of the military housing and quality of life services at Navy and Air Force Barrigada. As compared to Alternative 1, there would be a slight shift of emissions from the change in construction locations of these facilities among the affected ROIs. Therefore, the construction emissions, the construction effort for all airfields, waterfront, training and other non-firing training projects is assumed to be the same for Alternative 3 as for Alternative 1, as are air emissions associated with operational components.

5.2.4.1 North

Andersen AFB

Construction

Emissions that result from the proposed construction of airfield operations and training facilities at Andersen AFB for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-1.

Operation

Annual aircraft and on base vehicle operational emissions for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Tables 5.2-3, 5.2-4 and 5.2-5.

Finegayan

Construction

Emissions that result from the construction of training facilities for C3 and non-firing training facilities in Finegayan for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-1. Emissions from the construction of main cantonment facilities are summarized in Table 5.2-2.

Operation

Annual on base vehicle operational emissions for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

Non-DoD Land

Construction

Non-DoD land would be a part of the main cantonment as described in Chapter 2, and therefore construction and operation emissions were not calculated separately for this area. Construction emissions for the main cantonment for Alternative 3 are provided in Table 5.2-2

Operation

Table 5.2-4 provides operation emissions for North, which are considered to be the same as for Alternative 1.

5.2.4.2 Central

Andersen South

Construction

Emissions that result from the proposed construction of training facilities for C3, non-firing, and live-fire training in central Guam near Andersen South for Alternative 3 are assumed to be the same as those for Alternative 1 that are discussed in Section 5.2.2.2 and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during training exercises within Andersen South airspace and on base commuting vehicle emissions within Andersen South for Alternative 3 are assumed to be the same as those for Alternative 1, which are discussed in Section 5.2.2.2 and presented in Tables 5.2-3, 5.2-4 and 5.2-5.

Barrigada

Construction

Under Alternative 3, the placement of administration and maintenance facilities and housing is proposed within Navy Barrigada and Air Force Barrigada. Emissions from the construction of main cantonment facilities predicted under Alternative 3 are summarized in Table 5.2-2.

Operation

Annual on base vehicle operational emissions for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

Non-DoD Land

Construction

There would be no construction on non-DoD land in central Guam, as the area proposed for DoD use is limited to the Route 15 Parcel.

Operation

Annual vehicle emissions during training exercises within other areas in central Guam for Alternative 3 are assumed to be the same as those for Alternative 1.

5.2.4.3 Apra Harbor

Harbor

Construction

Emissions that result from the proposed construction of waterfront operations facilities at Apra Harbor for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.3 and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during the training exercises around Orote Airfield Harbor for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.3 and presented in Table 5.2-3.

Naval Base Guam

Construction

Construction proposed in the Naval Base Guam area is discussed in the previous section (Harbor).

Operation

Annual on base vehicle operational emissions for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

5.2.4.4 South

Naval Munitions Site

Construction

Emissions that result from the proposed construction of aviation training and non-fire Ranges at the NMS for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.4 and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during the training exercises and on base commuting vehicle emissions around NMS for Alternative 3 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.4 and presented in Tables 5.2-4 and 5.2-5.

5.2.4.5 Summary of Impacts

All air emissions would be well below the significance criteria of 250 TPY for all air pollutants except for CO. However, a further CO dispersion modeling analysis described in Volume 6 shows that no exceedances of CO NAAQS would occur from roadway traffic under the proposed action. Therefore, the potential CO impact is not considered significant although the 250 TPY threshold is exceeded. The predicted SO_2 emissions would below the 100 TPY *de minimis* level within the two nonattainment areas. Therefore, all project specific air quality impacts are considered less than significant for all areas for this action.

5.2.4.6 Proposed Mitigation Measures

The predicted construction emissions (2011 to 2016) and operational emissions (2015 and after) for criteria pollutants within each ROI are all below the 250 TPY threshold or 100 TPY SO_2 threshold applicable for SO_2 nonattainment areas. Therefore potential air quality impacts under Alternative 3 are considered less than significant and emissions mitigation measures are not warranted.

5.2.5 Alternative 8

This alternative includes construction at NCTS Finegayan with portions of the military housing and quality of life services at Navy and Air Force Barrigada. There would be a slight shift of emissions among affected regions of influence as compared to Alternative 1 due to the change in the construction locations of the facilities. Therefore, the construction emissions associated with main cantonment facilities under Alternative 8 were calculated for this alternative. The construction effort for all airfields, waterfront, training and other projects is assumed to be the same for Alternative 8 as for Alternative 1, as are air emissions associated with operational components.

5.2.5.1 North

Andersen AFB

Construction

Emissions that result from the proposed construction of airfield operations facilities and aviation training facilities at Andersen AFB for Alternative 8 are assumed to be the same as those for Alternative 1 that are described in Section 5.2.2.1 and presented in Table 5.2-1.

Operation

Annual aircraft and on base vehicle operational emissions for Alternative 8 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Tables 5.2-3, 5.2-4 and 5.2-5.

Non-DoD Land

Construction

Non-DoD land would be a part of the main cantonment as described in Chapter 2, and therefore construction and operation emissions were not calculated separately for this area. Construction emissions for the main cantonment for Alternative 8 are provided in Table 5.2-2.

Operation

Table 5.2-4 provides operation emissions for North, which is considered to be the same as for Alternative 1.

Finegayan

Construction

Emissions resulting from the construction of training facilities for C3 and non-firing training facilities in Finegayan for Alternative 8 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-1. Emissions from the construction of main cantonment facilities are summarized in Table 5.2-2.

Operation

Annual on base vehicle operational emissions for Alternative 8 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

5.2.5.2 Central

Andersen South

Construction

Emissions that result from the proposed construction of training facilities for C3, non-firing, and firing training near Andersen South for Alternative 8 are assumed to be the same as those for Alternative 1 that are discussed in Section 5.2.2.2 and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during training exercises within Andersen South airspace and on base commuting vehicle emissions within Andersen South for Alternative 8 are assumed to be the same as those for Alternative 1, which are discussed in Section 5.2.2.2 and presented in Tables 5.2-3, 5.2-4 and 5.2-5.

Barrigada

Construction

Under Alternative 8, the placement of administration and maintenance facilities and housing is proposed within Air Force Barrigada. There would be no construction in Navy Barrigada Emissions from construction activities associated with main cantonment facilities are predicted under Alternative 8 and summarized in Table 5.2-2.

Operation

Annual on base vehicle operational emissions for Alternative 8 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

Non-DoD Land

Construction

There would be no construction on non-DoD land in central Guam, as the area proposed for DoD use is limited to the Route 15 Parcel.

Operation

Annual vehicle emissions during training exercises within other areas in central Guam for Alternative 8 are assumed to be the same as those for Alternative 1.

5.2.5.3 Apra Harbor

Harbor

Construction

Emissions that result from the proposed construction of waterfront operations facilities at Apra Harbor for Alternative 8 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.3 and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during the training exercises around Orote Airfield Harbor for Alternative 8 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.3 and presented in Table 5.2-4.

Naval Base Guam

Construction

Construction proposed in the Naval Base Guam area is discussed in the previous section (Harbor).

Operation

Annual on base vehicle operational emissions for Alternative 8 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.1 and presented in Table 5.2-5.

5.2.5.4 South

Naval Munitions Site

Construction

Emissions that result from the proposed construction of aviation training and non-firing ranges at NMS for Alternative 8 are assumed to be the same as those for Alternative 1 that are described in Section 5.2.2.4 and presented in Table 5.2-1.

Operation

Aircraft flight operational emissions during the training exercises and on base commuting vehicle emissions around NMS for Alternative 8 are assumed to be the same as those for Alternative 1 and are described in Section 5.2.2.4 and presented in Tables 5.2-4 and 5.2-5.

5.2.5.5 Summary of Impacts

All air emissions would be well below the significance criteria of 250 TPY all air pollutants except for CO. However, a further CO dispersion modeling analysis described in Volume 6 shows that no exceedances of CO NAAQS would occur from roadway traffic under the proposed action. Therefore, the potential CO impact is not considered significant although the 250 TPY threshold is exceeded. The predicted SO_2 emissions would below the 100 TPY *de minimis* level within the two nonattainment areas. Therefore, all project specific air quality impacts are considered less than significant for all areas for this action.

5.2.5.6 Proposed Mitigation Measures

The predicted construction emissions (2011 to 2016) and operational emissions (2015 and after) for criteria pollutants within each ROI are all below the 250 TPY threshold or 100 TPY SO_2 threshold applicable for SO_2 nonattainment areas. Therefore potential air quality impacts under Alternative 8 are considered less than significant and emissions mitigation measures are not warranted.

5.2.6 No-Action Alternative

Under the no-action alternative, Marine Corps units would remain in Japan and would not relocate to Guam. No construction, dredging, training, or operations associated with the military relocation would occur and the Marine Corps would not meet readiness and mission requirements and U.S. international treaty obligations would not be met. Existing operations on Guam would continue. Therefore, implementation of the no-action alternative would maintain existing conditions and there would be no impacts associated with the proposed action and alternatives. The current level of air emissions would remain unchanged.

5.2.7 Summary of Impacts

Tables 5.2-7, 5.2-8, and 5.2-9, and 5.2-10 summarize the potential impacts of each action alternative (Alternatives 1, 2, 3, and 8) associated with the Main Cantonment, firing range training, ammunition storage, and NMS access roads. Table 5.2-11 summarizes the potential impacts of other training, airfield, and waterfront components of the proposed action. A text summary is provided below.

This evaluation assumed that the construction effort for all airfield, waterfront, and training associated projects would be essentially the same, regardless of location. Therefore, the estimates of air emissions associated with these construction activities calculated for Alternatives 1, 2, 3, and 8 are equal. However, the main cantonment-related construction emissions were estimated for each alternative given that there

are slight differences in the scale of earth disturbance among the four cantonment alternatives. The operational components of all four action alternatives are also considered to be the same and therefore the total predicted emissions for all action alternatives are also the same. The potential air emissions for the construction and operational components of Alternatives 1, 2, 3, and 8 are well below the significance criteria of 250 TPY except for CO, primarily due to on base vehicular trips. A further CO dispersion modeling analysis described in Volume 6 indicates that no exceedances of CO NAAQS would occur from roadway traffic under the proposed action. The potential CO impact is not considered significant although the 250 TPY threshold is exceeded. Therefore, Alternatives 1, 2, 3 and 8 would result in less than significant impacts to air quality resources. The no-action alternative would result in no impacts to air quality resources.

Table 5.2-7. Summary of Main Cantonment Impacts – Alternatives 1, 2, 3 and 8

Main Cantonment Alternatives 1, 2, 3, and 8
Construction
LSI • Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria
Operation
LSI • Less than significant adverse impacts to air quality. Operations emissions from all components would be well below significance criteria

Legend: LSI = Less than significant impact.

Table 5.2-8. Summary of Training Impacts – Firing Range Alternatives

Firing Range Alternatives A and B
Construction
LSI • Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria
Operation
LSI • Less than significant adverse impacts to air quality. Operations emissions from all components would be well below significance criteria

Legend: LSI = Less than significant impact.

Table 5.2-9 Summary of Training Impacts – Ammunition Storage Alternatives

Ammunition Storage Alternatives A and B
Construction
LSI • Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria
Operation
LSI • Less than significant adverse impacts to air quality. Operations emissions from all components would be well below significance criteria

Legend: LSI = Less than significant impact.

Table 5.2-10. Summary of Training Impacts – NMS Access Roads Alternatives

Access Road Alternatives A and B
Construction
LSI • Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria
Operation
LSI • Less than significant adverse impacts to air quality. Operations emissions from all components would be well below significance criteria

Legend: LSI = Less than significant impact.

Table 5.2-11 Summary of Other Training, Airfield, and Waterfront Component Impacts

Other Training (North/Central/South)	*Airfield (North)*	*Waterfront (Apra Harbor)*
Construction		
LSI • Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria	LSI • Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria	LSI • Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria
Operation		
LSI • Less than significant adverse impacts to air quality. Operations emissions from all components would be well below significance criteria	LSI • Less than significant adverse impacts to air quality. Operations emissions from all components would be well below significance criteria	LSI • Less than significant adverse impacts to air quality. Operations emissions from all components would be well below significance criteria

Legend: LSI = Less than significant impact.

The predicted construction emissions (2011 to 2016) and operational emissions (2015 and after) are combined with the emissions from other components of the proposed actions in Volume 7 to determine the potential air emissions impact significance from the combined preferred alternatives using the impact thresholds described in Section 5.2.1.2. A CAA general conformity applicability analysis is also provided for the total combined emissions within the two SO_2 nonattainment areas in Volume 7.

5.2.8 Summary of Proposed Mitigation Measures

As the predicted air emissions would result in less than significant impacts for all alternatives for both construction and operation components of the proposed action, no mitigation measures are warranted as summarized in Table 5.2-12. A discussion of whether mitigation measures for controlling emissions from all components of the preferred alternatives is provided in Volume 7, as the need for mitigation measures would ultimately be dependent on the combined air emissions. Even though impacts are less than significant for the proposed action and alternatives, Volume 7, Chapter 2 describes two additional mitigation measures; force flow reduction and adaptive program management. Implementing either of these mitigation measures could further reduce impacts to air quality by lowering peak population levels during construction.

Table 5.2-12. Summary of Proposed Mitigation Measures

Main Cantonment Alternatives	*Firing Range Alternatives*	*Ammunition Storage Alternatives*	*NMS Access Road Alternatives*	*Other Training. Airfield, and Waterfront Components*
Construction				
• No mitigation required	• No mitigation required	• No mitigation required	• No mitigation required	• No mitigation required
Operation				
• No mitigation required	• No mitigation required	• No mitigation required	• No mitigation required	• No mitigation required

USEPA has indicated that they are currently reviewing the existing SO_2 standard and expect to soon take final actions that could lead to a lower, more protective, standard. As part of this action, USEPA would require GovGuam to install at least one air monitor by 2013. USEPA recommended that DoD obtain baseline SO_2 monitoring data before construction commences to identify DoD's contributions to the SO_2 levels measured with the new 2013 monitor.

Although ambient air monitoring (e.g., for non-attainment or attainment designation) is primarily the responsibility of regulatory agencies, and due to the absence of ambient air monitoring baseline data, DoD proposes to install one ambient air monitoring station for SO_2 and particulate matter (PM). Consultation with USEPA and GEPA would determine the location of the air monitoring station and the station would be operated and maintained by GEPA. Also, DoD is proposing to install one air ambient monitor for SO_2 and PM near the northern Guam construction site as part of the effort to monitor and provide timely mitigation measures to control air emissions, if necessary, even though a mitigation measure is not warranted based on the EIS analysis. The air monitor would be installed before construction activities to obtain baseline data, operate during construction activities, and be removed after construction activities.