CHAPTER 7.
AIR QUALITY

7.1 INTRODUCTION

This chapter describes the potential environmental consequences associated with implementation of the alternatives within the four regions of influence (ROI) – North, Central, Apra Harbor, and South – for air quality resources. For a description of the affected environment for air quality resources, refer to Chapter 5 of Volume 2 (Marine Corps Relocation – Guam). The locations described in that volume include the ROIs for the utilities and off base roadway project components of the proposed action.

7.2 ENVIRONMENTAL CONSEQUENCES

The comprehensive air quality consequences analysis performed in this volume includes the following analysis components that examine potential impacts of utilities and roadway projects on Guam on air quality:

Utilities

- A microscale (localized) criteria pollutant analysis of potential impacts from a proposed major stationary source (i.e., power plant) for interim alternatives
- A Clean Air Act (CAA) general conformity applicability analysis of direct and indirect sulfur dioxide (SO_2) emission increases that would result from the proposed action within the two SO_2 nonattainment areas on Guam that were identified in Volume 2, Section 5.1.
- A net incremental emissions analysis of criteria pollutants and greenhouse gases (GHGs) in terms of carbon dioxide (CO_2) emissions with the potential to emit from the following stationary sources:
    - Power plant
    - Solid waste landfill facility
- A net incremental emissions analysis of criteria pollutants and CO_2 with the potential to emit from the following mobile sources:
- Construction equipment, hauling truck, and worker's commuting vehicle emissions during the construction period.

Roadway Projects

- A microscale carbon monoxide (CO) analysis of potential impacts from local traffic at congested intersections
- A qualitative particulate matter (PM) and primary mobile source air toxic analysis
- A microscale mobile source air toxic analysis of potential impacts from local traffic at congested intersections using USEPA recommended research guidance (TBD)
- A net incremental emissions analysis of criteria pollutants and CO_2 emissions with the potential to emit from the following mobile sources:
- Traffic-related on-road motor vehicle operations
- Roadway construction equipment and hauling truck emissions during the construction period.

Regional Analysis

The regional or mesoscale analysis of a project determines the overall impact of a project on regional air quality levels. A transportation project is analyzed as part of a regional transportation network developed by the County or State. Projects included in this network are found in GovGuam's *Territorial Transportation Improvement Plan* developed by the Department of Public Works. The Territorial Transportation Improvement Plan is the basis for the regional analysis, utilizing vehicle miles traveled (VMT) and vehicle hours traveled (VHT) within the region to determine daily "pollutant burden" levels. The results of this analysis determine if an area is in conformity with regulations set forth in the United States (U.S.) Environmental Protection Agency's (USEPA) Final Transportation Conformity Rule.

Particulate Matter

On March 10, 2006, the USEPA issued a Final Rule regarding localized or "hot-spot" analysis of particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) and particulate matter less than 10 microns in diameter (PM_{10}) (40 *Code of Federal Regulations* [CFR] Part 93). This rule requires that $PM_{2.5}$ hotspot analysis be performed only for transportation projects with significant diesel traffic in areas not meeting $PM_{2.5}$ air quality standards. The project area is classified as an attainment area for PM_{10} and $PM_{2.5.}$ The project is also not anticipated to generate additional diesel traffic. As such, a hot-spot analysis is not required.

Attainment of National Ambient Air Quality Standards (NAAQS)

The USEPA, under the requirements of the 1970 Clean Air Act (CAA), as amended in 1977 and 1990 (Clean Air Act Amendments [CAAA]), has established NAAQS for six contaminants, referred to as criteria pollutants (40 Code of Federal Regulations [CFR] 50). The regulations establish the NAAQS criteria in order to protect public health and the environment by limiting the amount of pollutants allowed in the ambient air. These six criteria pollutants are:

- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Ozone (O_3), with nitrogen oxides (NO_x) and volatile organic compounds (VOCs) as precursors
- Particulate matter (PM_{10}—less than 10 microns in particle diameter; $PM_{2.5}$—less than 2.5 microns in particle diameter)
- Lead (Pb)
- Sulfur dioxide (SO_2)

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.

Components of the proposed action would occur in various locations on Guam. Many of the areas where the actions are proposed are currently designated as attainment areas for all criteria pollutants. There are two areas on Guam that are designated as attainment areas for CO, NO_x, O_3, PM, and Pb, but are designated as nonattainment areas for SO_2, as follows:

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

The primary contributors of SO_2 in the environment are from burning fossil fuels such as fuel oil like that used by power plants, and gasoline used by vehicles. One way that EPA limits SO_2 emissions in the ambient air is to require the use of low sulfur fuels in power plants. It also limits the production and use of gasoline with a low sulfur content (termed "Tier 2 Standards"). These requirements were promulgated as part of the Clean Air Act (CAA), and implemented the CFRs. These low sulfur fuels are readily available in the continental U.S.

Although Guam is in nonattainment for SO_2 in the two areas around the Piti and Tanguisson power plants, on December 28, 2006 EPA issued a partial waiver to Guam that conditionally exempts Guam from the requirements to use low sulfur fuels in its power plants and in gasoline that is used islandwide in vehicles. The exemption also applies to American Samoa and the CNMI. In its decision to grant the partial waiver, EPA cited both economic and environmental reasons for granting the waiver:

> "We are exempting American Samoa, Guam, and CNMI from the Tier 2 gasoline sulfur standard due to the high economic burden of compliance, isolated nature of the territories, both in terms of gasoline importation and pollution transport, and minimal air quality effects."

> "Generally, the Far East market, primarily Singapore, supplies gasoline to the U.S. Pacific Island Territories. The Tier 2 sulfur standard effectively requires special gasoline shipments, which would increase the cost and could jeopardize the security of the gasoline supply to the Pacific Island Territories. The air quality in American Samoa, Guam, and C.N.M.I. is generally pristine, due to the wet climate, strong prevailing winds, and considerable distance from any pollution sources. We recognize that exempting the U.S. Pacific Island Territories from the gasoline sulfur standard will result in smaller emission reductions. However, Tier 2 vehicles using higher sulfur gasoline still emit 30% less hydrocarbons and 60% less nitrogen oxide (NO_X) than Tier 1 vehicles and negative effects on the catalytic converter due to the higher sulfur levels are, in many cases, reversible. Additionally, these reduced benefits are acceptable due to the pristine air quality, the fact that gasoline quality will not change, and the cost and difficulty of consistently acquiring Tier 2 compliant gasoline."

> "Guam is in attainment with the primary NAAQS, with the exception of sulfur dioxide in two areas. This action is not expected to have any significant impact on the ambient air quality status of Guam, including the status of the two areas designated as nonattainment for sulfur dioxide. Both areas are designated nonattainment for sulfur dioxide as a result of monitored and modeled exceedences in the 1970's prior to implementing changes to power generation facilities. In the 1990's both plants were rebuilt, upgrading their emission controls. Guam has submitted a redesignation request to EPA. That pending redesignation request shows that they are now in attainment. An emissions inventory shows that the power plants are the major source of SO_2 on Guam. Both plants are on the western side of the island. The Trade Winds blow persistently from east-to-west, further lessening the impact of the SO2 emissions on the people of Guam from the power plants."

> "Mobile sources, like cars, are a minor contributor to the SO_2 emission budget. Exempting Guam from the Tier 2 gasoline sulfur and vehicle emission standards would not cause an increase in emissions. Guam has received enforcement discretion for the Tier 2 gasoline sulfur standards from the onset of the program and therefore the gasoline sent to Guam has not been required to meet the Tier 2 sulfur levels. Emissions from older vehicles will remain unchanged. Tier 2 vehicles using high sulfur gasoline will be cleaner than Tier 1 vehicles. Tier 2 vehicles using gasoline with 330 ppm sulfur emit 30% less hydrocarbons and 60% less NOX than Tier 1 vehicles. While this rule will lead to a smaller reduction in emissions than would occur if the Tier 2 sulfur regulations are required, Guam's current air quality does not require further reductions. Because of Guam's remoteness, there are no cross border issues."

As cited in the EPA waiver decision, both Piti and Tanguisson areas are designated nonattainment for sulfur dioxide as a result of monitored and modeled exceedences in the 1970's prior to implementing changes to power generation facilities. Guam and EPA believes the area around Piti is now in attainment. The Tanguisson power plant is relatively far from sensitive land use areas. Since Guam is exempt from using low sulfur content fuel, it is anticipated that the allowance of using high sulfur content fuel by power generation facilities is the primary cause of the current nonattainment designation of the two areas.

<u>MSAT Analysis</u>

Mobile source air toxics (MSAT) are hazardous air pollutants, seven of which have been identified by the USEPA as mobile source pollutants of concern due to their high relative risk. These seven pollutants are: napthalene, acrolein, benzene, 1-3 butadiene, formaldehyde, polycyclic organic matter (POM) and diesel particulate matter plus diesel exhaust organic gases (DPM+DEOG). As part of the NEPA process, air toxics require review and evaluation as they could affect the quality of the human environment.

On February 3, 2006, the Federal Highway Administration (FHWA) issued Interim Guidance (FWHA 2006b) regarding mobile source air toxics (MSAT) analysis for National Environmental Policy Act (NEPA) documentation. Given the emerging state of the science and of project-level analysis techniques regarding MSATs, there are currently no established criteria for determining when MSAT emissions should be considered a significant issue. FHWA has suggested a tiered approached in determining potential project-induced MSAT impacts. The three tiers are:

- Tier 1 – No analysis for projects with no potential for meaningful MSAT effects. These projects include:
  - Projects qualifying as a categorical exclusion under 23 CFR 771.117(c)
  - Projects exempt under the CAA Conformity Rule under 40 CFR 93.126
  - Other projects with no meaningful impacts on traffic volumes or vehicle mix
- Tier 2 – Qualitative analysis for projects with low potential MSAT effects
- Tier 3 – Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects. These projects include:
  - Projects that would create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel PM in a single location
  - Projects that would create new or add significant capacity to urban highways, such as interstates, urban arterials, or urban collector-distribution routes with traffic volumes where the average annual daily traffic is projected to be in the range of 140,000 to 150,000 vehicles or greater by the design year
  - Projects located in proximity to populated areas or in rural areas, in proximity to concentrations of sensitive populations (i.e., schools, nursing homes, hospitals).

FHWA developed this approach because currently available technical tools do not reliably predict project-specific health impacts of the emission changes associated with projects.

However,USEPA has requested an MSAT analysis based on the methodology described in the research report "Analyzing, Documenting, and Communicating the Impacts of Mobile Source Air Toxic Emissions in the NEPA Process" prepared for the American Association of State Highway and Transportation Officials (ASHTO) (ICF International 2007). Given the unusual scale of the proposed relocation as compared to other Navy actions, and to accommodate USEPA's request as part of the NEPA disclosure process, additional MSAT analysis will be presented in the Final EIS/OEIS using the methodology based on the ASHTO report. The additional MSAT analysis will assess traffic volumes, particularly at intersections, and vehicle-hours for idling heavy duty diesel trucks during peak construction.

The methodology for MSAT analysis in the 2007 ASHTO report consists of a decision tree keyed to a set of policy-related questions to identify the appropriate level of analysis based on project information, potential community impact, and the public's level of concern. The policy-related questions are keyed to technical questions which identify the appropriate level of analysis based on health risk considerations. The following summarizes the levels of analysis in this alternate MSAT analysis.

- Level 1 – no review required (Projects that fall under a categorical exclusion)
- Level 2 – qualitative analysis recommended (Design activity less than 40,000 AADT for an intersection, or less than 100,000 AADT for an arterial, or less than 750 idling vehicle-hours per day for heavy duty diesel vehicles, or is a new or expanded intermodal facility)
- Level 3 – Level 2 plus quantitative emissions analysis (Design activity above those as listed in Level 2; MSAT exposure not identified as a concern during scoping process; no increase in sensitive population in proximity to MSAT emissions)
- Level 4 – Level 3 plus dispersion modeling to estimate concentration and risk from proposed action (Design activity above those as listed in Level 2; MSAT exposure identified as a concern during scoping process; increase in sensitive population in proximity to MSAT emissions; insufficient information on nearby population and human activity levels)
- Level 5 – Level 4 plus population activity pattern analysis to estimate exposure risk (Design activity above those as listed in Level 2; MSAT exposure identified as a concern during scoping process; increase in sensitive population in proximity to MSAT emissions; available information on nearby population and human activity levels)

It should be noted that the difference between the FHWA Interim Guidance and the method based on the ASHTO report is the criteria for when a quantitative analysis is required. The method based on the ASHTO report has a lower threshold in terms of traffic volumes and includes consideration of emissions from idling heavy duty diesel trucks. Projected traffic volumes are below the threshold for a quantitative analysis per the FHWA Interim Guidance, therefore the MSAT analysis provided in this DEIS is limited to a comparison of traffic volumes to the FHWA Interim Guidance threshold as well as a discussion on the limitations of methodologies for estimating emissions, concentrations, exposure levels and health effects.

Microscale CO Air Quality Analysis

Microscale air quality modeling was performed using the most recent version of the USEPA mobile source emission factor model (MOBILE6.2) (USEPA 2003b) and the CAL3QHC (Version 2.0) air quality dispersion model (USEPA 1995) to estimate future no-action (without the proposed project) and future build (with the proposed project) CO levels at selected locations in the project area.

Dispersion Model

Mobile source models are the basic analytical tools used to estimate CO concentrations expected under given traffic, roadway geometry, and meteorological conditions. The mathematical expressions and formulations that comprise the various models attempt to describe an extremely complex physical phenomenon as closely as possible. The dispersion modeling program used in this project for estimating pollutant concentrations near roadway intersections is the CAL3QHC (Version 2.0) dispersion model developed by USEPA and first released in 1992.

CAL3QHC is a Gaussian model recommended in the USEPA's *Guidelines for Modeling Carbon*

Monoxide from Roadway Intersections (USEPA 1992). Gaussian models assume that the dispersion of pollutants downwind of a pollution source follow a normal distribution from the center of the pollution source.

Different emission rates occur when vehicles are stopped (i.e., idling), accelerating, decelerating, and moving at different average speeds. CAL3QHC simplifies these different emission rates into two components:

- Emissions when vehicles are stopped (i.e., idling) during the red phase of a signalized intersection
- Emissions when vehicles are in motion during the green phase of a signalized intersection

The CAL3QHC (Version 2.0) air quality dispersion model has undergone extensive testing by USEPA and has been found to provide reliable estimates of inert (i.e., nonreactive) pollutant concentrations resulting from motor vehicle emissions. A complete description of the model is provided in the *User's Guide to CAL3QHC (Version 2.0): A Modeling Methodology for Predicting Pollutant Concentrations near Roadway Intersections (Revised)* (USEPA 1995).

Vehicular Emissions

Vehicular emissions were estimated using the USEPA MOBILE6.2 vehicular emission factor model. (USEPA 2003b). MOBILE6.2 is a mobile source emission estimate program that provides current and future estimates of emissions from highway motor vehicles. The latest in the MOBILE series, which dates back to 1978, MOBILE6.2 was designed by USEPA to address a wide variety of air pollution modeling needs and incorporates updated information on basic emission rates, more realistic driving patterns, separation of start and running emissions, improved correction factors, and changing fleet composition. It also includes impacts of new regulations promulgated since the previous version, MOBILE5b released in 1996.

Site Selection and Receptor Locations

A screening evaluation was performed to identify which intersections in the project area are most congested and most affected by the build alternatives. Sites fail the screening evaluation if: 1) the level of service (LOS) decreases below D in one of the build alternatives compared to the no-action alternative, or 2) if the delay and/or volume increase from the no-action to build alternatives along with an LOS below D. The LOS describes the quality of traffic operating conditions, ranging from A to F, and it is measured as the duration of delay that a driver experiences at a given intersection. LOS A represents free-flow movement of traffic and minimal delays to motorists. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in congestion.

<u>Determination of Significance</u>

Potential project impacts were evaluated against the appropriate thresholds and regulations set forth by the federal and local government, including USEPA and Guam Environmental Protection Agency (GEPA).

7.2.1 Approach to Analysis

7.2.1.1 Methodology

<u>Utility Stationary Sources</u>

The following new or existing stationary sources are associated with the utility development:

- Major power generation facilities under three interim and three long-term alternatives. Power facilities would use Number (No.) 6 oil fuel, No.2 oil fuel, or liquefied natural gas (LNG)
- Wastewater treatment plant under two interim and four long-term alternatives
- One preferred solid waste landfill alternative

Given the limited design specifics provided for the programmatic long-term alternatives, the air quality impact analysis cannot be performed at this time and, if required, may be addressed in separate NEPA documents in the future. Therefore, only the potential impact from applicable interim alternatives are quantitatively analyzed in this document. For long-term alternatives, a qualitative impact discussion is provided.

The major facility-associated potential annual emissions under each interim alternative are predicted based on the interim design capacities discussed in this EIS/OEIS and on manufacturer-provided emission factors or using USEPA-approved emission factor models. USEPA emission factor models that were used include:

- USEPA AP-42 Compilation of Air Pollutant Emission Factors for Stationary Point and Area Sources (USEPA 1995 and after) – AP-42 provides emission factors for combustion source emissions
- Landfill Gas Emissions model (LandGEM) (USEPA 2005a) – LandGEM is a screening tool to assist in estimating emission rates for total landfill gas, methane, CO_2, and non-methane VOCs from municipal solid waste landfills

A detailed discussion on emissions estimates is provided in Volume 9, Appendix I, Sections 3.1 Major Stationary Sources and 3.2 Minor Stationary Sources.

Annual emissions thresholds for air pollutants for a major source and a major source modification are summarized in Table 7.2-1. For sources with annual emission levels exceeding the threshold of a major stationary source or major modification of the existing major stationary source, microscale ambient concentration levels from these sources are predicted and compared with the applicable significance thresholds. The analysis is conducted in accordance with the NEPA requirements, and the air-permitting requirements established in various USEPA programs and GEPA's Air Pollution Control Standards and Regulations (APCSR) Section 1104.6 (c) (12) (ix) (GEPA 2004).

Table 7.2-1. Applicable Major Source and Major Modification Thresholds

Pollutant	*Major Source Threshold (TPY)*	*Major PSD Source Threshold (TPY)*	*Major Modification Threshold (TPY)*
Sulfur dioxide (SO2)	100	250/100[a]	40
Carbon monoxide (CO)	100	250/100[a]	100
Particulate matter (PM10)	100	250/100[a]	15
Nitrogen oxide (NOx)	100	250/100[a]	40
Volatile organic compounds (VOCs)	100	250/100[a]	40

Legend: PSD = Prevention of Significant Deterioration; TPY = tons per year.
Note: [a] 100 TPY applies to certain sources such as fossil fuel fired steam electric plants with more than 250 British thermal unit per hour heat input
Source: USEPA (40 CFR 52).

As discussed in Section 5.1 of Volume 2, Prevention of Significant Deterioration (PSD) regulations were established by the USEPA to ensure that air quality in clean (attainment) areas does not significantly deteriorate and that a margin for future industrial growth is maintained. This is to be accomplished by requiring major emission sources and major modifications to employ the best available control technology (BACT) to curb air pollutant emissions.

According to CAA regulations, a facility is considered to be a major source when annual emissions exceed 100 TPY of any criteria pollutants in an attainment area or a SO_2 nonattainment area. Under the PSD regulations, last modified under the 1990 CAA Amendments (42 U.S. Code §§7470-7479), a facility is considered to be a major stationary source when annual emissions exceed 250 or 100 tons per year (TPY) of attainment pollutants, depending on the specific source category. Examples of source categories with a 100 TPY major stationary source threshold include fossil-fuel-fired steam electric plants with more than 250 British thermal units (Btu) per hour heat input and many specific types of plants, mills, and smelters. For an existing major stationary source, the net emission increase of each attainment pollutant that exceeds a specified significant emission increase level is considered to be a major modification that is subject to the provisions of the PSD regulations and a PSD new source review (NSR).

Because Guam has two nonattainment areas for SO_2, a nonattainment NSR would be required by the project for SO_2 if the proposed stationary facility and the existing major stationary source modification within the SO_2 nonattainment area exceed the nonattainment NSR threshold. If applicable, the new sources would likely be required to use lowest achievable emission rate (LAER) technology, obtain emission offsets to satisfy the nonattainment NSR regulatory requirements, and reduce overall emissions facility-wide. Nonattainment area-specific regulations on emission offsets are provided in Guam APCSR Sections 1105.4 and 1105.5.

For each identified major stationary source or major modification of an existing major source under the proposed alternatives, the estimated emission rates were further used in ambient concentration dispersion modeling, as discussed below.

The dispersion modeling approach is designed to estimate near-field impacts, defined as within a 31-mile (mi) (50-kilometer [km]) transport radius (USEPA 2005b). The modeling approach was developed in accordance with the following USEPA guidance:

- Guideline on Air Quality Models (Revised), incorporated as Appendix W of 40 CFR Part 51, Federal Register (FR) Revision to the Guideline on Air Quality Models (USEPA 2005b)
- Draft New Source Review Workshop Manual (USEPA 1990)

The USEPA-recommended regulatory dispersion model for near-field applications, American Meteorological Society/USEPA Regulatory Model (AERMOD) (USEPA 2007), was used for interim alternative impact analysis. AERMOD is a steady-state plume dispersion model that simulates transport and dispersion from multiple point, area, or volume sources based on an up-to-date characterization of the atmospheric boundary layer. The model employs hourly sequential pre-processed meteorological data to estimate concentrations for selected averaging times ranging from 1 hour to 1 year.

Because the existing sources to be impacted under interim alternatives are located inland in areas remote from coastal effects, and under the influence of the relatively constant nature of the trade winds, the near-source steady-state regulatory model, AERMOD, is an appropriate tool for estimating air impacts from the affected existing major stationary sources.

The hourly emission rates and the daily and annual emission rates, as appropriate, from the existing sources to be utilized under interim alternatives were used as the inputs to AERMOD in order to determine both long-term (annual) and short-term (24-hour average or shorter) impact concentration levels with repect to the applicable impact thresholds. The PSD Significant Impact Levels (SILs) were used as the basis for evaluating potential impact significance from three power interim alternatives.

A detailed discussion of dispersion modeling methodology, meteorological data, receptor grid used, and dispersion modeling results is provided in Volume 9, Appendix I, Section 3.1 Major Stationary Sources.

Utility Construction Mobile Sources

Potential air quality impacts from mobile sources were evaluated in terms of net incremental annual emissions levels for each criteria pollutant and CO_2 associated with each source type and the annual activity level. The mobile sources considered in this volume include construction equipment and hauling truck emissions during the utility resources construction period.

Construction activities involving the operation of construction equipment, trucks, and workers' commuting vehicles may have short-term air quality impacts.

In order to predict construction emissions, estimates of construction crew and equipment requirements and productivity including the hours of equipment use were made, based on the data presented in 2003 *RSMeans Facilities Construction Cost Data* (RSMeans 2003) and 2006 *RSMeans Heavy Construction Cost Data* (RSMeans 2006). Given the lack of a specific construction schedule for each applicable project during the early planning stage, the overall length of utility construction for each project is assumed to be 4 years from 2011 through 2014. The subsequent emissions for construction were evenly distributed over the 4-year construction period to determine the average annual emissions levels.

Estimates of construction equipment operational emissions were based on: 1) the estimated hours of equipment use as described above and 2) the emission factors for each piece of equipment, as provided by the USEPA in the NONROAD emission factor model based on the national default model inputs (USEPA 2008b). The average equipment horsepower values and equipment power load factors are also provided in association with the NONROAD emission factors. Because the operational activity data presented in RSMeans' books are generated based on the overall duration of equipment presence on site, an equipment actual running time factor (i.e., actual usage factor) was further employed to determine actual equipment usage hours for the purposes of estimating equipment emissions. The usage factor for each equipment type was obtained from FHWA's Roadway Construction Noise Model User's Guide (FHWA 2006a). Emission factors related to construction-associated delivery trucks and workers' commuting vehicles were estimated using the USEPA Mobile6 emission factor model (USEPA 2003b). The detailed methodology used to calculate these emissions is presented in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Under the General Conformity Rule (GCR), emissions associated with all operational and construction activities from a proposed federal action, both direct and indirect, 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
- The emissions caused by the federal action are reasonably foreseeable

As previously mentioned, Guam has two SO_2 nonattainment areas around the Piti and Tanguisson power plants. The emissions from both stationary and mobile sources with potential to occur within the two SO_2 nonattainment areas were quantified using the same methodologies discussed previously for both stationary and mobile sources. If a proposed stationary and/or mobile source emission level is below the de minimis threshold, it is exempt from the GCR. Also, according to the GCR, if a proposed stationary source is a major stationary source or major PSD source that is required to be in compliance with the PSD and/or nonattainment NSR programs, it is exempt from the GCR. Therefore, if a proposed stationary source is a major source that triggers a PSD/Nonattainment NSR program, the operational emissions from this source are not considered in the general conformity applicability analysis.

Estimates of direct and indirect annual emissions within SO_2 nonattainment areas for utility resources are described in detail in Volume 9, Appendix I, Section 3.6 CAA General Conformity Applicability Analysis.

Roadway Mobile Sources

The primary on-road vehicle-related air pollutants are CO, PM, nitrogen oxide (NO_x), and VOCs (NO_x and VOCs are precursors to the formation of ozone). The project-level air quality impacts of traffic-related projects are generally evaluated on the following two scales for specific pollutants:

- Microscale (hot-spot) level for CO and PM (PM_{10} and $PM_{2.5}$). A microscale analysis of traffic-related impacts at intersections or free flow sites provides estimates of localized pollutant concentrations for direct comparison to the NAAQS and/or applicable impact thresholds.
- Mesoscale (regional) level for NO_x, VOC, CO, and PM (PM_{10} and $PM_{2.5}$). Emissions of these typical pollutants are calculated on a mesoscale basis to provide a comparison of regional emissions among alternatives.

On-road vehicular emissions impacts are predicted to estimate the CO concentration levels at the worst-case congested intersections under future conditions with and without the proposed action. If the model-predicted CO levels are below the NAAQS at the worst-case congested intersections, the traffic-related microscale air quality impacts are expected to be in compliance at other less-congested intersections where lower emissions would be generated.

The potential traffic-related PM ($PM_{2.5}$ and PM_{10}) impact hot-spot analyses were not warranted based on the guidelines and procedures outlined by the USEPA in *Transportation Conformity Guidance for Qualitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (USEPA 2006a).

The FHWA and USEPA have issued interim joint guidance for the assessment of MSAT in the NEPA process for highways (FHWA 2006b), which includes specific criteria for determining:

- Projects that are exempt from mobile source air toxic analysis requirements
- Projects that may require a qualitative analysis
- Projects that should undergo a quantitative assessment

The roadways with the greatest potential to be impacted by the proposed improvements would be mostly microscale local arterial roadways on Guam connected to each project site. The change in traffic volume and truck percentage was analyzed along the major travel routes. These quantitative forecasts and discussions are provided in this EIS/OEIS in accordance with FHWA guidance on air toxics analysis (FHWA 2006b).

The traffic forecasts and the future sensitive land use condition along the roadway network discussed in Chapter 4 would be used to determine the level of the analysis that would be applicable for the alternate analysis based on the ASHTO report as requested by the USEPA. If a microscale MSAT analysis is required based on the criteria as detailed in Section 7.2, a similar approach as utilized for the CO impact analysis would be implemented.

The mesoscale vehicular and roadway construction emissions of criteria pollutants as well as GHG in terms of CO_2 emissions were also considered through an estimate of vehicular emissions on the affected roadway system on Guam and construction equipment emissions during roadway construction.

7.2.1.2 Determination of Significance

The selected impact thresholds (significance criteria) for making a determination of the significance of impact using the analysis approach outlined in the previous section are summarized in Table 7.2-2 along with measuring metrics for individual utilities and roadway project mobile sources.

Microscale Concentration Impact

For major stationary emission source impacts, the PSD SILs shown in Table 7-2.3 were used to evaluate the incremental impact significance potentially resulting from the proposed operations of each modified existing PSD source individually under each interim alternative. If a predicted impact concentration showed no exceedances of the corresponding PSD SIL, the source is not considered to have a significant impact for that specific attainment pollutant and no further analysis is necessary for the corresponding pollutant. Conversely, if the PSD SILs are predicted to be exceeded, the EIS chooses that a further mitigation modeling analysis of the affected existing major sources would be required to eliminate the potential PSD SIL exceedance.

For traffic-related microscale impacts, the predicted CO concentrations at the worst-case congested intersections were compared with the CO NAAQS to determine the potential significance of traffic-related microscale air quality impacts. Additionally, the alternate MSAT analysis to be conducted and included in the Final EIS/OEIS will use the MSAT thresholds established in the ASHTO 2007 research report to evaluate potential health risk, as per the USEPA recommendation.

GCR *de minimis* Threshold

Under the GCR, total emissions resulting from the proposed federal actions must be compared to applicable *de minimis* levels on an annual basis. As defined by the GCR, if the emissions of a criteria pollutant (or its precursors) do not exceed the *de minimis* level, the federal action has minimal air quality impact and the action is determined to be in conformity for the pollutant under study. Therefore, no further analysis is necessary. Conversely, if the total direct and indirect emissions of a pollutant are above the *de minimis* level, a formal general conformity determination is required for that pollutant. According to the GCR, the *de minimis* level applicable to the two nonattainment areas on Guam is 100 TPY for SO_2. Therefore, if the total direct and indirect emissions of SO_2 are below 100 TPY, no formal conformity determination is required and no significant air quality impact would result from the implementation of the proposed action.

Table 7.2-2. Impact Analysis Thresholds

Emission Sources	*Measuring Metric*	*Significance Criteria*
Utility Operation and Construction Emissions		
Power plant	Criteria pollutant concentration from the proposed existing power plant modification	PSD Significant Impact Levels
	Criteria pollutant emissions	PSD and NSR source threshold
Solid waste landfill	VOC emission	250 TPY[a] (PSD major stationary

Emission Sources	*Measuring Metric*	*Significance Criteria*
Construction of power, water, wastewater and landfill facilities	Criteria pollutant emissions	source threshold)
Construction mobile source and non-major stationary source operation within nonattainment areas	SO_2 annual emissions in Piti and Tanguisson nonattainment areas	100 TPY[a] (de minimis level)
Roadway Project Mobile Sources		
On-road vehicles	CO concentration	NAAQS
On-road vehicles	PM and air toxics emissions discussion	N/A
Mesoscale on-road vehicle emissions and roadway construction emissions	Criteria pollutant emissions	250 TPY[a] (PSD major stationary source threshold)
All sources with emission factor data	CO_2 emissions	N/A

Legend: N/A = Not applicable.
Note: [a] Emissions from corresponding source activities are combined with the emissions from other components of the Proposed Action and presented in Volume 7. These impact significance threshold are considered as *de minimis* levels and are used to make an impact determination from a disclosure comparison with the combined annual emission levels. However, if such levels are exceeded for a specific pollutant, a further formal analysis is considered, when appropriate, in order to make a formal determination of impact significance.

Table 7.2-3. PSD Significant Impact Levels

Pollutant	*Averaging Period*	*Significant Impact Level ($\mu g/m^3$)*
NO_2	Annual	1
SO_2	Annual 24-hour 3-hour	1 5 25
PM_{10}	Annual 24-hour	1 5
$PM_{2.5}$	Annual 24-hour	1 5
CO	8-hour 1-hour	500 2,000

Legend: $\mu g/m^3$ = microgram per cubic meter.
Source: 40 CFR 51.165.

It should be noted that according to the GCR, if a proposed stationary source is a major stationary source or major PSD source that is required to be in compliance with the regulations established in the PSD and/or nonattainment NSR programs, the emissions from this source are exempt from the general conformity requirement. Therefore, the proposed operational emissions from those PSD/NSR sources within the nonattainment area should not be included in the comparison with the SO_2 *de minimis* criterion.

Mobile Source and Non-Major Stationary Source Incremental Emissions

Under the CAA, motor vehicles, other self-propelled vehicles with internal combustion engines, and non-self-propelled non-road engines are exempt from air-permitting requirements. The GCR is not applicable to these mobile source emissions associated with the construction and operation of the proposed improvements in areas that are in attainment of the NAAQS for all criteria pollutants. Nonetheless, 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 emissions criteria for determining the significance of air quality impacts from such sources in CAA attainment areas.

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

As noted above, neither the PSD permitting program nor the GCR are applicable to mobile sources and 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 the alternatives under NEPA. However, since the 250 TPY threshold is selected in the context of the *de minimis* threshold established in the GCR providing only an indication of potential significant impact, a further formal impact analysis should be conducted if such threshold is exceeded, 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.

7.2.1.3 Issues Identified During Public Scoping Process

The impact analyses focus on addressing potential air quality impacts from the proposed utility and roadway improvement actions. As part of the analyses, public concerns, including those of regulatory stakeholders, raised during public scoping meetings that relate to air quality effects were addressed (if sufficient project data and available impact criteria were available). Concerns relating to potential air quality impacts are listed below:

- Increase in vehicle and vessel emissions, and need for disclosure of available information of health risks associated with vehicle emissions and MSAT
- Increase in emissions from existing power sources due to power demand or construction of new power sources
- Increase 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
- Emissions mitigation plans during construction
- Discussion of a potential installation of an air quality monitoring network on Guam
- Discussion of project elements that would be major contributors to greenhouse gases (GHGs) and identification of practices or project elements to reduce GHGs
- Need to control and monitor the buildup activities to ensure good air quality on Guam

7.2.2 Power

7.2.2.1 Historical Monitoring Observations and Existing Background Conditions

The existing major stationary source contributions under current operational conditions around the ROIs where the proposed power improvement actions (interim alternatives 2 and 3) would occur were evaluated to establish the existing condition. The ROIs with the potential to be affected by the proposed power improvement actions include North, Central, and Apra Harbor.

The 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 (TSP), SO_2, NO_2, and nitrogen monoxide (NO). In 1991, PM_{10} was monitored in addition to TSP.

Prior to 1991, TSP were monitored at 20 sites, SO2 at 14 sites, NO2 at five sites, and NO at one site. In 1991, PM10 was monitored at four sites.

In addition to the historical monitoring identified above, the GPA established a network of five stations to measure SO2 at locations that are not downwind or close to any major electrical generating units (EGUs) during normal trade wind conditions from the fall of 1999 through the summer of 2000. All of the observed SO2 concentrations were below the 24-hour NAAQS. According to 40 CFR Parts 80 and 86, Guam has submitted a redesignation request to EPA. That pending redesignation request shows that they are now in attainment; however, EPA has not taken action on this request, so the areas remain in a nonattainment status. EPA did, however, recognize the need for this redesignation in their decision to allow a waiver for the use of low sulfur fuels in power plants and vehicles in Guam (see Section 7.2, "National Ambient Air Quality Standards"). An emissions inventory shows that the power plants are the major source of SO2 on Guam. Both plants are on the western side of the island. The Trade Winds blow persistently from east-to-west, further lessening the impact of the SO2 emissions on the people of Guam from the power plants. Mobile sources, like cars, are a minor contributor to the SO2 emission budget.

The areas around affected existing sources (Figure 7.2-1) under the three interim alternatives are in attainment areas. Ambient air quality conditions are expected to be affected by existing stationary source operations and other minor source operations such as vehicular traffic. Since the comparisons of the modeling results with PSD SILs (see Table 7.2-3) were used as the basis for evaluating potential impact significance from the three interim alternatives, ambient background conditions were not considered in the study.

7.2.2.2 Interim Alternative 1 (Preferred Alternative)

Interim Alternative 1 would recondition existing combustion turbines and upgrade T&D systems and would not require new construction or enlargement of the existing footprint of the facility. This work would be undertaken by the GPA on its existing permitted facilities. Reconditioning would be made to existing permitted facilities at the Marbo, Yigo, Dededo, and Macheche combustion turbines. These combustion turbines are not currently being used up to permit limits. T&D system upgrades would be on existing above ground and underground transmission lines. This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

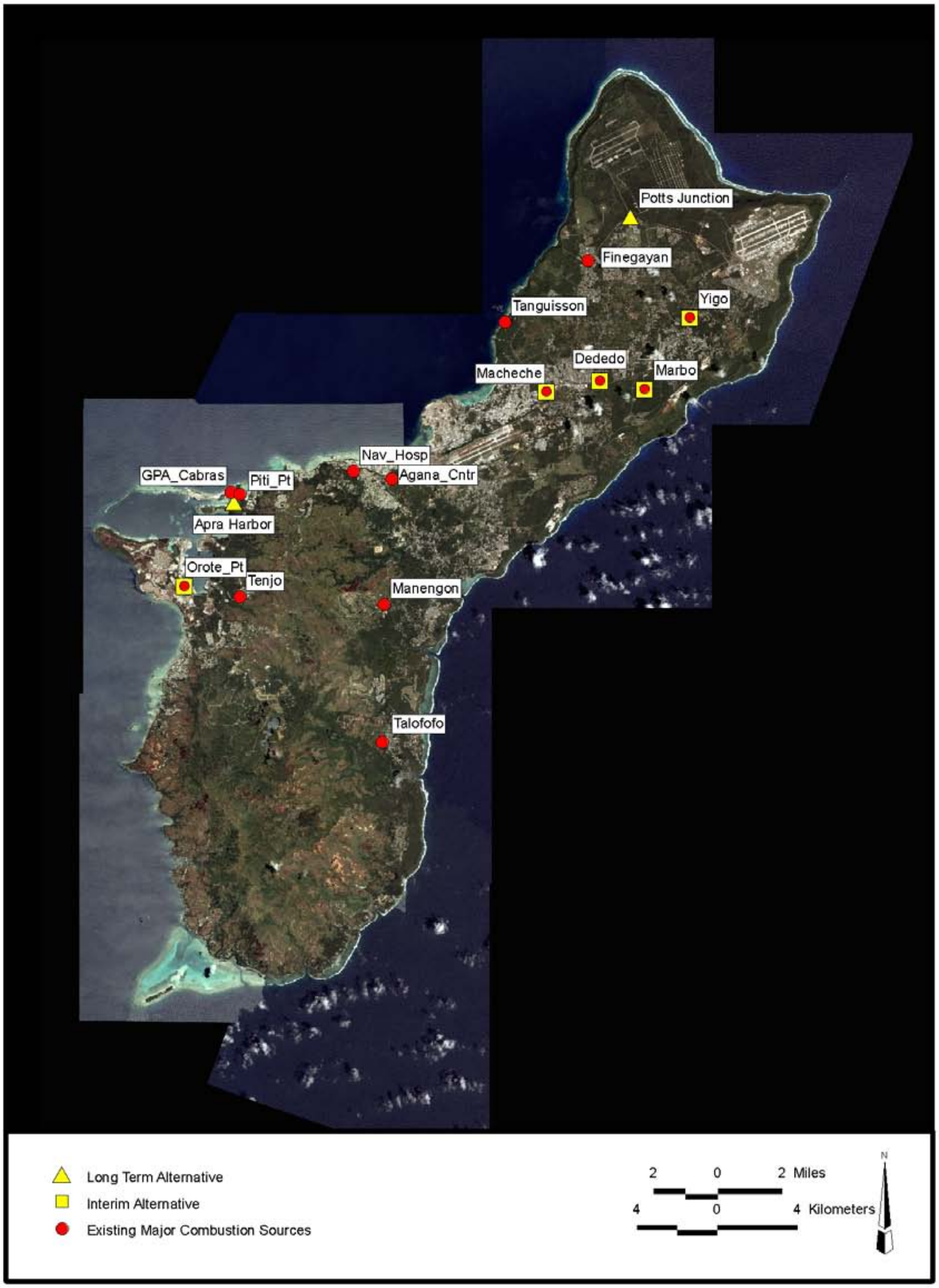

Figure 7.2-1. Locations of Candidate Major Existing EGU Sources on Guam

Construction

Table 7.2-4 presents the total annual construction emissions for Interim Alternative 1 that were calculated for the utilization and repair of the combustion turbines, and associated facility transmission line upgrade, using the methodology described in Section 7.2.1.1 and described in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-4. Total Annual Construction Emissions – Interim Alternative 1

Construction Activity	*Pollutant*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Total Annual Emissions (TPY)	0.1	3.8	0.0	0.0	0.4	0.1	52.0

Operation

Potential increases of air emissions, as compared to existing power operation actual conditions, are anticipated from the proposed action. For NEPA disclosure purposes, the annual emissions above the current actual condition were approximately estimated based on the percentage increase in power output required at each affected CT and summarized in Table 7.2-5. A detailed calculation is discussed in Volume 9, Appendix I, Section 3.1.4.4 Interim Alternative Criteria Pollutant Impact Analysis.

However, it is anticipated that the majority of increase in power required during the interim period would not exceed the permitted capacity at each affected CT, for which the compliance of any applicable CAA air quality standards had been already demonstrated during the air permitting process when GPA obtained the air permit for each affected source. Therefore, in addition to disclosing the net increase in emissions above the current actual emissions levels, the EIS/OEIS focuses on addressing the air quality impact at those CTs that require an increase in permitted capacity.

Because the overall permitted capacity and the operational scheme for these combustion turbines would not change, the resulting potential air quality impact would remain the same as the current permitted conditions established previously during each facility permitting process. Since the Interim Alternative 1 would not result in any increase of air emissions at these facilities under the permitted condition, utilization or reconditioning these permitted sources is in compliance with any applicable CAA air quality standards and would not result in a significant air quality impacts.

Table 7.2-5. Net Increase in Annual Emissions – Interim Alternative 1

Affected Source	*Pollutant*					
	SO_2	*CO*	*PM_{10}*	*NO_x*	*VOC*	*CO_2*
Dededo CT#1	907.1	87.4	82.4	345.4	16.6	120,780.1
Dededo CT#2	907.1	87.4	82.4	345.4	16.6	120,780.1
Yigo	245.0	49.0	74.9	101.8	15.9	53,561.1
Marbo	212.1	32.3	10.5	110.8	0.14	24,154.8
Macheche	134.3	25.0	22.0	67.6	0.45	23,888.2
Combined Sources	2,405.6	281.0	272.1	970.9	49.8	343,164.4
Net Increase in Potenital to Emit Above Permitted Capacity						
All Affected Sources	0	0	0	0	0	0

Potential Mitigation Measures

Potential mitigation measures, if applicable to construction activity-associated emissions, are discussed in Volume 7 where the combined air quality effects are addressed.

Since no significant operational air quality impact would occur under this alternative, mitigation measures would not be required.

7.2.2.3 Interim Alternative 2

Interim Alternative 2 is a combination of reconditioning of existing permitted GPA facilities, an increase in operational hours for existing combustion turbines, and upgrades to existing T&D systems. Interim Alternative 2 would not require new construction or enlargement of the existing footprint of the facility. Reconditioning would be performed on the existing permitted GPA facilities at the Marbo, Yigo, and Dededo combustion turbines. This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

Construction

Total annual construction emissions for Interim Alternative 2 are shown in Table 7.2-6. Emissions would likely be similar to, but slightly lower than Interim Alternative 1 because the scale of construction, repair activities, and the transmission line upgrade is slightly smaller than Interim Alternative 1. Construction emissions are discussed in more detail in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-6. Total Annual Construction Emissions – Interim Alternative 2

	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
Total Annual Emissions (TPY)	0.4	2.1	0.0	0.0	0.1	0.0	16.2

Operation

This alternative is a phased combination of utilizing existing permitted facilities that would be undertaken by GPA to meet the power demands associated with the Marine Corps relocation to Guam. The existing GPA facilities that would be utilized are Dededo, Yigo, and Marbo plants. Among them, the operational permitted capacity would need to be increased at only the Yigo plant. The Yigo plant permitted annual hours of operation would increase from 4,280 hours per year to 7,760 hours per year. The expansion-associated increases in criteria pollutant emissions were predicted and are summarized in Table 7.2-7 using the methodology presented in Volume 9, Appendix I, Section 3.1.4.4 Interim Alternative Criteria Pollutant Impact Analysis. The level of emissions increases are above the major modification thresholds summarized in Table 7.2-1. In addition to the criteria pollutants, the greenhouse gas emission increase in terms of CO_2 was also estimated using the USEPA AP-42 emission factors associated with the size of combustion turbine Yigo uses (USEPA 1995 and after). The change of emissions levels at Yigo is significant and would require obtaining a permit modification for Yigo's Title V and PSD permits under Interim Alternative 2.

Table 7.2-7. Net Increase in Annual Emissions – Interim Alternative 2

Affected Source	*Annual Emissions (TPY)*					
	SO_2	*CO*	*PM_{10}*	*NOx*	*VOC*	*CO_2*
Dededo CT#1	859.4	82.8	78.0	327.2	15.8	114,423.3
Dededo CT#2	859.4	82.8	78.0	327.2	15.8	114,423.3
Yigo	470.4	94.1	143.8	195.5	30.5	102,823.1
Marbo	199.6	30.4	9.9	104.2	0.1	22,734.0
Combined Sources	2,388.7	290.0	309.7	954.1	62.2	354,403.7
Net Increase in Potenital to Emit Above Permitted Capacity						
Yigo	234.4	46.9	71.65	97.4	15.32	51,234.9
Other Affected Sources	0	0	0	0	0	0

Since the short-term emission rates for all three stationary sources (Yigo, Marbo, Dededo) would not change from the existing conditions, no short-term impacts under Interim Alternative 2 would occur. For both short-term and annual average conditions, the concentration levels under Interim Alternative 2 were predicted through the dispersion modeling around the Yigo power plant, and are described in Volume 9, Appendix I, Section 3.1.4.4 Interim Alternative Criteria Pollutant Impact Analysis.

Based on the predicted incremental concentration from Yigo alone, the annual levels were predicted to exceed the PSD SIL of 1 μg/m^3 for SO_2 (Table 7.2-8). In order to improve the existing conditions under Interim Alternative 2, mitigation measures would be considered to ensure that PSD SILs would not be exceeded. These measures could include 1) increasing the CT stack height, or 2) utilizing low sulfur content diesel fuel with 0.05% sulfur, as compared to the current 0.6% content, or 3) increasing stack exit velocity. However, the detailed mitigation measures would be determined during the design and permit application stage. The mitigation modeling analysis conducted assumes an increase of current stack height to 32 meters. Under such improved source conditions, the model-predicted incremental concentration levels are all below the PSD SILs (Table 7.2-9). Moreover, the worst-case short-term concentration levels would be below the existing condition levels. Therefore, under mitigated Interim Alternative 2 conditions, the short-term existing ambient air quality conditions would be generally improved around the Yigo Plant and no significant air quality impacts would occur.

Table 7.2-8. Predicted Criteria Pollutant Concentrations at Yigo – Interim Alternative 2

Pollutant	*Averaging Period*	*Baseline Yigo only μg/m^3*	*Proposed Yigo only μg/m^3*	*Proposed Yigo only Maximum Increment μg/m^3*	*PSD SIL μg/ m^3*
NO_2	Annual	0.777	1.407	0.630	1
SO_2	Annual	2.319	4.200	1.882	1
	24-hour	34.442	34.442	NA	5
	3-hour	131.460	131.46	NA	25
PM_{10}	Annual	0.370	0.672	0.301	1
	24-hour	4.687	4.687	NA	5
$PM_{2.5}$	Annual	0.354	0.643	0.288	1
	24-hour	2.475	2.475	NA	5
CO	8-hour	17.612	17.612	NA	500
	1-hour	30.338	30.338	NA	2,000

Table 7.2-9. Predicted Criteria Pollutant Concentrations at Yigo – Mitigated Interim Alternative 2

Pollutant	*Averaging Period*	*Baseline Yigo only μg/m³*	*Proposed Mitigated Yigo only μg/m³*	*Proposed Mitigated Yigo only Maximum Increment μg/m³*	*PSD SIL μg/m³*
NO_2	Annual	0.777	0.932	0.306	1
SO_2	Annual	2.319	2.781	0.915	1
	24-hour	34.442	15.339	0.503	5
	3-hour	131.46	33.834	1.622	25
PM_{10}	Annual	0.370	0.445	0.147	1
	24-hour	4.687	2.189	0.0804	5
$PM_{2.5}$	Annual	0.354	0.418	0.138	1
	24-hour	2.475	1.315	0.0804	5
CO	8-hour	17.612	4.934	0.194	500
	1-hour	30.338	6.516	0.377	2,000

Potential Mitigation Measures

The predicted construction emissions for criteria pollutants within each ROI are all below the 250 tpy threshold. Therefore potential air quality impacts under Interim Alternative 2 are considered less than significant and emissions mitigation measures are not warranted.

The predicted operational concentrations around the affected Yigo CT, at which a permit modification would be required, exceed the PSD SILs. Therefore, operational air quality impacts under Interim Alternative 2 are considered potentially significant but mitigatable to less than significant with the measures evaluated. As discussed previously, an increase of Yigo CT stack height would not only eliminate the potential exceedances of PSD SILs but also result in an improvement of current existing air quality conditions around Yigo Plant.

7.2.2.4 Interim Alternative 3

Interim Alternative 3 is a combination of reconditioning existing GPA permitted facilities at Marbo, Yigo, and Dededo and upgrades to the Navy power plant at Orote. Upgrades would be made to existing T&D. The proposed reconditioning to the existing power generation facilities at Marbo, Yigo, and Dededo would not require new construction or enlargement of the existing footprint of the facility. For the Orote power plant, upgrades would include a new fuel storage facility to facilitate longer run times between refueling. This would disturb approximately 1 acre (4,047 square m). This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

Construction

The calculated annual construction emissions under Interim Alternative 3 are summarized in Table 7.2-10 and described in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-10. Total Annual Construction Emissions – Interim Alternative 3

	Pollutant						
Construction Activity	*SO_2*	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Total Annual Emissions (TPY)	0.6	3.0	0.0	0.0	0.2	0.1	23.3

Operation

Interim Alternative 3 combines elements of Interim Alternatives 1 and 2 with phased utilization of existing GPA-permitted facilities at Marbo, Yigo, and Dededo, and the Navy's Orote Point plant. The differences in Interim Alternative 3 as compared to Interim Alternative 2 are the modification of the Orote Point plant in Apra Harbor/Central Guam West area. Interim Alternative 3 would increase hours of operation at Yigo from the permitted 4,280 hours per year to 7,760 hours per year. Orote hours of operation would increase from 1,350 hours per year (3 units combined) to 7,884 hours (3 units combined).

Table 7.2-11 presents the emission rates utilized for the annual modeling scenario based on the increase in the annual hours of operation at Yigo and Orote Point. The Dededo and Marbo annual emission rate would remain unchanged. The short-term modeling scenario is the same as the existing source modeling, as no change is proposed to short-term operation of the unit.

The increases in annual emissions levels estimated above the current permitted levels are considered significant, as shown in Table 7.2-11, and described in Volume 9, Appendix I, Section 3.1.4.4 Interim Alternative Criteria Pollutant Impact Analysis. The Yigo and Orote facilities would require permit modifications for both Title V and PSD permit under Interim Alternative 3.

Table 7.2-11. Net Increase in Annual Emissions – Interim Alternative 3

Affected Source	*Annual Emissions (TPY)*					
	SO2	*CO*	*PM10*	*NOx*	*VOC*	*CO2*
Dededo CT#1	763.9	73.6	69.4	290.8	14.0	101,709.6
Dededo CT#2	811.6	78.2	73.7	309.0	14.9	108,066.4
Yigo	444.3	88.9	135.8	184.6	28.8	97,110.7
Marbo	137.2	20.9	6.8	71.7	0.1	15629.6
Orote	107.2	28.5	32.2	448.5	34.8	27,857.3
Combined Sources	2,264.2	290.0	317.9	1,304.6	92.6	350,373.7
Net Increase in Potenital to Emit Above Permitted Capacity						
Orote Point	111.1	29.5	33.4	464.6	36.0	28,859.0
Yigo	234.4	46.9	71.65	97.4	15.32	51,234.9
Other Affected Sources	0	0	0	0	0	0

Since the short-term emission rates would not change from the existing conditions, no short-term impact under Interim Alternative 3 would occur. For the annual average condition, concentration levels under Interim Alternative 3 were predicted through the dispersion modeling around Orote and Yigo. The concentrations predicted around the Yigo power plant are the same as shown in Table 7.2-8. The modeling results around Orote are summarized in Table 7.2-12, and are discussed in detail in Volume 9, Appendix I, Section 3.1.4.4 Interim Alternative Criteria Pollutant Impact Analysis. The PSD SIL of 1 $\mu g/m^3$ annual average level would be exceeded for SO_2 and NO_2 at Orote. As presented in Table 7.2-8, the PSD SIL of 1 $\mu g/m^3$ annual average level would also be exceeded for SO_2 at Yigo.

Table 7.2-12. Predicted Criteria Pollutant Concentrations at Orote from Interim Alternative 3

Pollutant	*Averaging Period*	*Baseline Orote only μg/m^3*	*Proposed Orote only μg/m^3*	*Proposed Orote only Maximum Increment μg/m^3*	*PSD SIL μg/m^3*
NO_2	Annual	1.408	8.232	6.824	1
SO_2	Annual	0.449	2.632	2.183	1
	24-hour	36.184	36.184	NA	5
	3-hour	50.780	50.780	NA	25
PM_{10}	Annual	0.014	0.080	0.066	1
	24-hour	1.027	1.027	NA	5
$PM_{2.5}$	Annual	0.013	0.077	0.064	1
	24-hour	0.760	0.760	NA	5
CO	8-hour	12.068	NA	NA	500
	1-hour	24.603	NA	NA	2,000

Because the incremental concentration from Orote and Yigo were predicted to exceed the PSD SIL of 1 μg/m^3 for SO_2 and/or NO_2, mitigation measures would be considered through 1) increasing the modified CT stack heights for the Yigo and Orote power plants, 2) increasing stack exit velocities at Orote, and 3) adding NOx control for the three units at Orote. A more detailed discussion of the proposed type of add-on control to the NOx emissions at Orote is described in Volume 9, Appendix I, Section 3.1.4.4, Interim Alternative Criteria Pollutant Impact Analysis.

Although the detailed mitigation measures would be determined during the design and permit application stage, the mitigation modeling analysis conducted assumes a combination of 1) an increase of the Yigo current stack height to 32 meters and the Orote current stack heights to 45 meters, 2) increasing the stack exit velocities to 55.0 m/s for each stack at Orote power plants, and 3) adding NOx control for the three units at the Orote power plant.

Under such mitigated source conditions, the model-predicted incremental concentration levels for each facility are all below the PSD SILs (Tables 7.2-9, 7.2-13, and 7.2-14, also presented in Volume 9, Appendix I, Section 3.1.4.4, Interim Alternative Criteria Pollutant Impact Analysis). The modeling results of the combined sources of Orote and Yigo under the mitigation condition are summarized in Table 7.2-14.

Therefore, under Interim Alternative 3 mitigated conditions, no significant air quality impacts would occur.

Table 7.2-13. Predicted Criteria Pollutant Concentrations at Orote from Mitigated Interim Alternative 3

Pollutant	*Averaging Period*	*Baseline Orote only $\mu g/m^3$*	*Proposed Orote only $\mu g/m^3$*	*Proposed Orote only Maximum Increment $\mu g/m^3$*	*PSD SIL $\mu g/m^3$*
NO_2	Annual	1.408	0.868	0.008	1
SO_2	Annual	0.449	1.114	0.719	1
	24-hour	36.184	16.082	3.807	5
	3-hour	50.780	22.671	23.617	25
PM_{10}	Annual	0.014	0.034	0.022	1
	24-hour	1.027	0.445	0.115	5
$PM_{2.5}$	Annual	0.013	0.032	0.021	1
	24-hour	0.760	0.309	0.115	5
CO	8-hour	12.068	5.516	3.019	500
	1-hour	24.603	17.410	15.533	2,000

Table 7.2-14. Predicted Criteria Pollutant Concentrations from Mitigated Interim Alternative 3 Combined Sources

Pollutant	*Averaging Period*	*Baseline $\mu g/m^3$*	*Proposed $\mu g/m^3$*	*Proposed Maximum Increment $\mu g/m^3$*	*PSD SIL $\mu g/m^3$*
NO_2	Annual	1.419	0.932	0.307	1
SO_2	Annual	2.319	2.782	0.916	1
	24-hour	36.248	16.146	3.807	5
	3-hour	131.46	33.834	23.617	25
PM_{10}	Annual	0.370	0.445	0.147	1
	24-hour	4.687	2.189	0.115	5
$PM_{2.5}$	Annual	0.354	0.418	0.147	1
	24-hour	2.475	1.315	0.115	5
CO	8-hour	17.615	5.534	3.019	500
	1-hour	30.338	17.410	15.533	2,000

Potential Mitigation Measures

The predicted construction emissions for criteria pollutants within each ROI are all below the 250 tpy threshold. Therefore potential air quality impacts under Interim Alternative 3 are considered less than significant and emissions mitigation measures are not warranted.

The predicted operational concentrations around the affected Yigo CT and Orote Plant, at which permit modifications would be required, exceed the PSD SILs. Therefore operational air quality impacts under Interim Alternative 3 are considered potentially significant but mitigatable to less than significant with the measures evaluated. As discussed previously, a combination of increasing stack heights and/or exit velocities at Yigo and Orote power plants and adding-on NOx controls at Orote plant would eliminate potential exceedances of PSD SILs under Interim Alternative 3.

7.2.2.5 Hazadous Air Pollutants Under Interim Alternatives 2 and 3

HAP emissions from combustion turbines at Yigo and Orote Point were based on existing permit levels established in existing Title V permits for each facility. Under the proposed Interim Alternatives 2 and 3, the only variable that changed for each operating scenario was the annual hours of operation, while there would be no change under Interim Alternative 1. Based on the applicable hours of operation of the CTs for interim alternatives 2 and 3, the total resultant HAPs emissions above the permitted levels and the incremental differences for the CTs at Yigo and Orote were calculated and are provided in Table 7.2-15, and described in Volume 9, Appendix I, Section 3.1.5, Interim Alternatives 2 and 3 HAPs Emissions Analysis. Since the total HAP resultant levels at each modified source would be well below the major source threshold (25 TPY of total HAPs), the increase in total HAP level under each interim alternative is not considered significant.

Table 7.2-15. HAPs Emissions and Incremental Increase Above Permitted Level for Combustion Turbines

	Yigo	*Orote Point*
Total Current HAP Emissions (TPY)	0.64	0.06
Total Proposed HAP Emissions (TPY)	1.16	0.36
Incremental Difference (TPY)	0.52	0.30

7.2.2.6 Greenhouse Gas Emissions Under Interim Alternatives 2 and 3

GHG emissions in terms of CO_2 from combustion turbines at Yigo and Orote Point were calculated using USEPA AP42 emission factors (USEPA 1999, 2000), permit information, and manufacturer data. Specifically, a fuel input emission factor for distillate oil-fired turbines of 157 pound (lb)/MMBtu from USEPA (USEPA 2000) was used.

Heat input for each of the combustion turbines was calculated using manufacturer provided engine capacity output in MWs, and assumed an engine efficiency of 40% (as noted within the Yigo permit statement of basis) to generate input capacities for each turbine.

For Yigo and Orote Point, CO_2 emissions were calculated for both current operations and proposed future operations to determine the incremental change in CO_2 emissions. The only variable that would change for each operating scenario is the annual hours of operation. Based on the applicable hours of operation of the combustion turbines for both operating scenarios and the MW output of each engine, the total resultant CO_2 emissions and the incremental differences above the permitted levels for the combustion turbines at Yigo and Orote Point were calculated and are provided in Table 7.2-16 and described in Volume 9, Appendix I, Section 2.5, Greenhouse Gas Emissions.

Table 7.2-16. CO2 Emissions and Incremental Increase Above Permitted Level for Combustion Turbines

	Yigo	*Orote Point*
Total Current CO2 Emissions (TPY)	63,013.05	5,962.68
Total Proposed CO2Emissions (TPY)	114,247.96	34,822.07
Incremental Difference (TPY)	51,234.91	28,859.39

7.2.2.7 Summary of Impacts

Table 7.2-17 summarizes the potential air quality impacts associated with each of the interim alternatives. Construction activities for all alternatives would result in less than a significant impact to air quality resources because the existing power facility reconditioning associated emissions were well below the significance criterion of 250 TPY. Operational activities for Interim Alternative 1 would also result in less than significant impacts to air quality resources because required power output would be within the CAA Title V permitted capacity for each affected existing facility. Therefore the utiliazation and reconditioning alternatives. Since the affected existing facilities had demonstrated their compliance under the permitted condition with all CAA regulations and standards in obtaining Title V permits, Interim Alternative 1 would result in less than a significant impact. Under Interim Alternatives 2 and 3, potentially significant impacts could occur due to a requirement of increasing the permitted capacity at Yigo CT and/or Orote Plant resulting in permit modifications. However, the mitigation measures discussed previously would reduce potentially significant impacts to less than significant air quality impacts.

Table 7.2-5. Summary of Potential Air Quality Impacts – Power

	Interim Alternative 1	*Interim Alternatvie 2*	*Interim Alternative 3*
Power	LSI	SI-M	SI-M

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact.

7.2.3 Potable Water

Water resource facilities to providing potable water for the proposed action would consist of various water pumps operated periodically for a number of processes. Water pumps are expected to be powered by electricity; therefore, no air emissions would be generated during water pumping operations. The potential air quality impacts addressed in this chapter only include estimates of air emissions associated with the construction of water resources.

7.2.3.1 Basic Alternative 1 (Preferred Alternative)

Basic Alternative 1 would consist of installation of up to 22 new potable water supply wells at Andersen Air Force Base (AFB), rehabilitation of existing wells, interconnection with the GWA water system, and associated T&D systems. A new 5 MG (19 ML) water storage tank would be constructed at ground level at Finegayan.

Construction

Estimates on construction activities were calculated to identify equipment, material, and manpower requirements for the construction associated with the proposed water resources components. Assumptions were made to develop a list of major construction items, necessary equipment, and productivity levels necessary for the completed construction of these facilities. The calculated emissions produced from potential construction and vehicle activities that would occur from 2011 to 2014 form the basis from which the total air pollutant emissions in TPY were calculated (Table 7.2-18).

These predicted emissions are combined with the emissions from other components of the proposed action in Volume 7 to determine the overall potential air emissions impact significance using the impact thresholds described in Section 7.2.1.2. The construction emissions shown in Table 7.2-18, and described in Volume 9, Appendix I, Section 3.4, Construction Activity Emissions, are all well below impact thresholds.

Table 7.2-18. Total Annual Construction Emissions –Alternative 1

Construction Activity	*Pollutant*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Total Annual Emissions (TPY)	0.3	2.2	0.2	0.2	2.7	0.3	422.9

Operation

As described at the beginning of this section, water pumps are expected to be powered by electricity, therefore no air emissions would be generated during water pumping operations.

Potential Mitigation Measures

Potential mitigation measures, if applicable, are discussed in Volume 7 where the combined air quality impacts are addressed.

7.2.3.2 Basic Alternative 2

Basic Alternative 2 would consist of installation of up to 20 new potable water supply wells at Andersen Air Force Base (AFB), up to 11 new potable water supply wells at Barrigada, rehabilitation of existing wells, interconnection with the GWA water system, associated transmission and distribution systems upgrades. Additionally, new 3.6 MG (13.6 ML) and 1 MG (3.8 ML) water storage tanks would be constructed at ground level at Finegayan and Barrigada, respectively.

Construction

The improvements planned for in Basic Alternative 2 would produce slightly lower total annual construction emissions than Alternative 1, as summarized below in Table 7.2-19 and presented in Volume 9, Appendix I, Section 3.4, Construction Activity Emissions.

Table 7.2-19. Total Annual Construction Emissions –Alternative 2

Construction Activity	*Pollutant*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Total Annual Emissions (TPY)	1.2	2.0	0.2	0.2	2.6	0.3	398.4

Operation

As described previously, water pumps are expected to be powered by electricity; therefore, no air emissions would be generated during water pumping operations.

Potential Mitigation Measures

The predicted construction emissions (2011 to 2014) 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.

7.2.3.3 Summary of Impacts

Table 7.2-20 summarizes the potential air quality impacts associated with the two potable water alternatives. The construction activities associated with the water supply were well below the significance criterion of 250 TPY. Water pumps are expected to be powered by electricity so that no air emissions would be generated during water pumping operations. Therefore, both alternatives would result in less than significant impacts to air quality resources.

Table 7.2-20. Summary of Potential Air Quality Impacts – Potable Water

	Basic Alternative 1	*Basic Alternative 2*
Potable Water	LSI	LSI

Legend: LSI = Less Than Significant Impact.

7.2.4 Wastewater

Construction and operation of waste water treatment facilities would generate additional air emissions, including odor-related emissions. This section addresses potential air quality impacts, including odor impacts from the proposed interim and long-term alternatives using the methodologies described in Section 7.2.1. Given the relatively short duration of the construction period (i.e., mostly between 2011 and 2014), odor impacts under the interim alternatives were addressed qualitatively. A detailed analysis is provided in Volume 9, Appendix I, Section 3.2.1 Annual Operation Emissions for Wastewater Treatment.

7.2.4.1 Basic Alternative 1a (Preferred Alternative) and 1b

Basic Alternative 1 (Alternative 1a supports Main Cantonment Alternatives 1 and 2; and Alternative 1b supports Main Cantonment Alternatives 3 and 8) combines upgrade to the existing primary treatment facilities and expansion to secondary treatment at the Northern District Wastewater Treatment Plant (NDWWTP). The difference between Alternatives 1a and 1b is a requirement for a new sewer line from Barrigada housing to NDWWTP for Alternative 1b.

Construction

The plant construction activities would result in a short-term increase in criteria pollutant and CO_2 emissions. However, given the small scale of the activity, the emissions predicted are minimal and would have negligible air quality impacts associated with them, as shown in Table 7.2-21 and described in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions. In Volume 7, these emissions are combined with the emissions from other components of the proposed action to determine the overall significance of potential air emissions impacts using the impact thresholds described in Section 7.2.1.2.

Table 7.2-21. Total Annual Construction Emissions - Alternative 1a and 1b

Construction Activity	*Pollutant*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Total Annual Emissions (TPY)	0.0	0.0	0.0	0.0	0.0	0.0	1.4

Operation

As additional wastewater flow would be treated at the NDWWTP, no changes to baseline operation impacts are predicted for Alternative 1a or 1b.

Potential Mitigation Measures

Potential mitigation measures, if applicable, are discussed in Volume 7, where the combined air quality impacts are addressed.

7.2.4.2 Long-Term Alternatives 1 through 4

Given the incomplete design data provided for these programmatic long-term alternatives, potential air quality impacts resulting from these alternatives are not analyzed in this study and, if required, would be addressed in a future NEPA document. However, given the size of a typical treatment plant and the limited combustion sources, potential criteria pollutants and HAP air quality impacts are expected to be minimal under both construction and operational conditions.

However, potential odor emissions from the long-term wastewater treatment facilities are expected to be significant particularly within the neighborhoods located around each facility, and given the relatively high temperature in Guam. Odor control measures are anticipated to be required for each long-term alternative.

7.2.4.3 Summary of Impacts

Table 7.2-22 summarizes the potential impacts associated with Basic Alternatives 1a and 1b for wastewater treatment. The construction and operation activities associated with wastewater facilities under this alternative would be well below the significance criterion of 250 TPY and therefore the alternative would result in less than significant impacts to air quality resources.

Table 7.2-22. Summary of Potential Air Quality Impacts – Wastewater

	Alternative 1a and 1b
Wastewater	LSI

Legend: LSI = Less Than Significant Impact

7.2.5 Solid Waste

Operation of the existing Navy Landfill at Apra Harbor to handle additional solid waste generated as a result of the proposed action would increase air emissions. This section addresses potential air quality impacts from Alternative 1 using the methodologies described in Section 7.2.1. A detailed analysis is provided in Volume 9, Appendix I, Section 3.2.2 Annual Operational Emissions for Solid Waste Disposal.

7.2.5.1 Basic Alternative 1 (Preferred Alternative)

The Preferred Alternative for solid waste would be the continued use of Navy Landfill at Apra Harbor until Layon Landfill is opened, which is scheduled for July 2011.

Construction

For Solid Waste Basic Alternative 1, there would be no new construction. Therefore, there are no construction impacts to air quality.

Operation

The USEPA LandGEM model (USEPA 2005a) was used to predict the increase in VOC and CO_2 emissions associated with the added solid waste disposal at the Navy Sanitary Landfill from the proposed action. The 2008 existing landfill throughput (input) based on 7.4 lbs (3.4 kg) per capita per day waste generation rate is considered as the baseline condition. The future additional waste throughput associated with Alternative 1 utilizing the Navy Sanitary Landfill was considered to begin in 2009 and the resulting net annual increases in air emissions, shown in Table 7.2-23, were predicted up to 2010.

Table 7.2-23. Total Annual Operation Emissions – Basic Alternative 1 / Apra Harbor

Year	*Pollutant (TPY)*		
	Uncontrolled VOC	*Controlled VOC*	*CO_2*
2010	1.0	N/A	62.9

Once the new Layon Landfill is opened, solid waste from the Navy Sanitary Landfill would be diverted to Layon per the Memorandum of Understanding between the DoD and GovGuam. The new landfill is assumed to open in 2011 and close in 2036.

The same methodology used for Basic Alternative 1 in Apra Harbor was used to predict the increase in VOC and CO_2 emissions associated with the added solid waste disposal at the proposed GovGuam landfill beyond 2011. Table 7.2-24 summarizes the predicted emissions for each year after the interim period. According to the Revised Final Report: Guam Solid Waste Utility Study for Proposed USMC Relocation (HDR/Hawaii Pacific Engineers 2008), a flare system to control VOC emissions would be installed in 2013. Therefore, the controlled VOC emission increase shown in Table 7.2-24 for 2014 reflects the presence of a flare controlling VOC emissions with a destruction rate of 98% or greater (USEPA 2003b).

Table 7.2-24. Total Annual Operation Emissions – Basic Alternative 1 / Layon

	Pollutant (TPY)		
Year	*Uncontrolled VOC*	*Controlled VOC*	*CO_2*
2011	2.7	N/A	170
2012	4.3	N/A	273
2013	6.2	N/A	399
2014	N/A	0.2	624
2015	N/A	0.3	946
2016	N/A	0.4	1,422
2017	N/A	0.6	1,908
2018	N/A	0.7	2,371
2019	N/A	0.9	2,812
2020	N/A	1.0	3,239
2021	N/A	1.1	3,645
2022	N/A	1.3	4,032
2023	N/A	1.4	4,400
2024	N/A	1.5	4,749
2025	N/A	1.6	5,082
2026	N/A	1.7	5,399
2027	N/A	1.8	5,700
2028	N/A	1.9	5,986
2029	N/A	2.0	6,258
2030	N/A	2.0	6,517
2031	N/A	2.1	6,764
2032	N/A	2.2	6,998
2033	N/A	2.3	7,221
2034	N/A	2.3	7,433
2035	N/A	2.4	7,635
2036	N/A	2.5	7,827

Legend: N/A = Not Applicable.

The predicted construction and operational emissions are combined with the emissions from other components of the Proposed Action in Volume 7 to determine the overall significance of potential air emissions impacts using the thresholds described in Section 7.2.1.2.

Potential Mitigation Measures

Mitigation measures, if applicable, for combined air quality effects are discussed in Volume 7.

7.2.5.2 Summary of Impacts

Table 7.2-25 summarizes the potential air quality impacts associated with the solid waste alternatives. The construction activities associated with solid waste facilities were well below the significance criterion of

250 TPY for all alternatives, as were operational emissions of criteria pollutants. Therefore, Alternative 1 would result in less than significant impacts to air quality resources with standard control measures.

It should be noted that CO_2 is not a criteria pollutant and therefore is not compared to criteria pollutant thresholds. The potential effects of CO_2 and other GHG emissions are by nature global and are based on cumulative impacts. Individual sources are not large enough to have an appreciable effect on climate change. Hence, the impact of proposed CO_2 and other greenhouse gas emissions is discussed in the context of cumulative impacts in Volume 7.

Table 7.2-25. Summary of Potential Air Quality Impacts – Solid Waste

	Alternative 1 / Apra Harbor	*Alternative 1 / Layon*
Solid waste	LSI	LSI

Legend: LSI = Less Than Significant Impact.

7.2.6 Off Base Roadways

Roadway projects are covered by four alternatives for the location of the cantonment area functions and family housing/community support functions, as summarized below. A detailed description of these alternatives is provided in Volume 2.

- Alternative 1. Represents one contiguous location for cantonment area functions and family housing/community support functions. It would include portions of Naval Computer and Telecommunications Station (NCTS) Finegayan and South Finegayan, as well as acquisition or long-term leasing of non-DoD lands at the former Federal Aviation Administration (FAA) parcel and the Harmon Annex parcel. A portion of the development would be constructed in the undeveloped overlay refuge.
- Alternative 2. Represents one contiguous land area for the cantonment and family housing /community support functions. It would include portions of NCTS Finegayan, portions of South Finegayan, and the acquisition or long-term leasing of portions of privately-held lands in the former FAA parcel. A portion of the development would be constructed in the undeveloped overlay refuge.
- Alternative 3. Plans for the main cantonment to include portions of NCTS Finegayan, and housing would be located on three geographically separated DoD parcels, including South Finegayan, Air Force Barrigada, and Navy Barrigada. No privately held lands would be acquired. Housing would be located non-contiguous to the main cantonment functions and a portion of the main cantonment would be constructed in the undeveloped overlay refuge.
- Alternative 8. would include portions of NCTS Finegayan, a portion of South Finegayan, the former FAA parcel, and a portion of the housing would be located on the geographically separated Air Force Barrigada parcel. A portion of privately held lands would be acquired by purchase or long-term lease. A portion of the main cantonment would be constructed in the undeveloped overlay refuge and a portion of the required housing would be non-contiguous to the Main Cantonment Area.

7.2.6.1 Alternative 1

Mesoscale Emissions Burden

Air quality impacts would also result from the provision of on-road vehicle operations and roadway constructions associated with the proposed action. As shown in Table 7.2-26 and Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1, regional emissions are predicted to increase from 18% to 19% under Alternative 1 as, compared to the no-action alternative. This is primarily due to the estimated 18% increase in VMT under Alternative 1.

Table 7.2-26. Regional Annual Emission Burdens, Alternative 1

Scenario	*VMT*	*Speed*	*Emission Burden (tpy)*						
			CO	*NO_x*	*VOC*	*PM_{10}*	*$PM_{2.5}$*	*SO_2*	*CO_2*
2030 No-Action Alternative	3,535,224	28.6	13,388	478	801	78	57	562	80,499
2030 Alternative 1	4,160,544	28.0	15,813	566	951	91	67	661	94,687
Net Change from No-Action			2,425	88	150	13	10	99	14,188
Percent Change from No-Action			18%	18%	19%	18%	18%	18%	18%

Legend: CO = carbon monoxide; VOC = volatile organic compounds; $PM_{2.5}$= particulate matter less than 2.5 microns in diameter;
PM_{10} = particulate matter less than 10 microns in diameter; tpy = tons per year; NOx = nitrogen oxides;
VMT = vehicle miles traveled.

North

Mobile Source Air Toxics

Technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project; however, even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is possible to qualitatively assess the levels of future MSAT emissions under the project. Although a qualitative analysis cannot measure potential health impacts from MSATs, it can give a basis for identifying and comparing the potential differences in MSAT emissions, if any, from the alternatives. The qualitative assessment presented below is derived in part from *A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives* developed by FHWA (FHWA 2009) and is also presented in Volume 9, Appendix I, Section 3.3.7.1 Off Base On-road Vehicle Operational Emissions and Impact Methodology.

Based on the recommended tiering approach detailed in the FHWA methodology, the project falls within the Tier 3 category as a project with potential impacts on traffic volumes or vehicle mix. As shown in Table 7.2-26, the project is predicted to increase daily VMT by 18% and associated regional emissions by 18% to 19%. This is considered a significant increase in traffic for the project area.

FHWA requires quantitative emissions analysis for projects that involve new or additional capacity on roadways where the traffic volume would be 140,000 to 150,000 average annual daily traffic (AADT). The 2030 average daily traffic (ADT) estimates for the three most traveled roadways under Alternative 1 are shown in Table 7.2-27 and described in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1. Since the ADTs are less than 140,000 for the design year, a MSAT analysis is not required.

Table 7.2-27. Average Daily Traffic for Major Roadways, Alternative 1

Roadway	*Alternative 1 No Build*	*Alternative 1 Build*
Route 1	95,600	95,600
Route 8	58,500	58,600
Route 18	70,500	70,500

Roadway widening may also have the effect of moving some traffic closer to nearby homes, schools, businesses, and other locations where sensitive receptors may be present. Sensitive receptors include those facilities most likely to contain large concentrations of the more sensitive population. These include hospitals, schools, licensed day cares, and elder care facilities.

There may also be localized areas where ambient concentrations of MSATs could be higher under the action alternatives than under the no-action alternative. Dispersion studies have shown that the “roadway” air toxics start to drop off at approximately 328 ft (100 m). By 1,640 ft (500 m), most studies have found it very difficult to distinguish the roadway from background toxic concentrations in any given area; however, as discussed previously, the magnitude and duration of these potential increases compared to the no-action alternative cannot be accurately quantified because of the inherent deficiencies of current models. When new travel lanes are constructed, the localized level of MSAT emissions for the action alternatives could be higher relative to the no-action alternative, but this could be offset due to increases in localized speeds and reductions in congestion that are associated with lower MSAT emissions. In addition, MSATs would be lower in other locations when traffic shifts away from them; however, on a regional basis, USEPA’s vehicle and fuel regulations, coupled with fleet turnover, would cause region-wide MSAT levels to be significantly lower than today in almost all cases.

This air quality section includes a basic analysis of the likely MSAT emission impacts of this project; however, available technical tools do not enable us to predict project-specific health impacts of the emission changes associated with the project alternatives. As a result of these limitations, the following discussion is included in accordance with the Council on Environmental Quality’s (CEQ) regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

Information that is Unavailable or Incomplete

Evaluating the environmental and health impacts from MSATs on a proposed roadway project would involve several key elements, including emissions modeling, dispersion modeling to estimate ambient concentrations resulting from the estimated emissions, exposure modeling to estimate human exposure to the estimated concentrations, and then a final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of the proposed action as follows:

- **Emissions**. The USEPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of roadway projects.
- **Dispersion**. The tools to predict how MSATs disperse are also limited. USEPA’s current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of CO to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to

predict accurate exposure patterns at specific times at specific roadway project locations across an urban area to assess potential health risk.

- **Exposure Levels and Health Effects**. Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year (lifetime or chronic) cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology, which affects emissions rates, over a 70-year period.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs

Research into the health impacts of MSATs is ongoing. For different emission types, a variety of studies show some statistical associations with adverse health outcomes through epidemiological studies that are frequently based on emissions levels found in occupational settings or using animal studies that demonstrate adverse health outcomes when animals are exposed to large doses.

Exposure to toxics has been a focus of many USEPA efforts. Most notably, the agency conducted the National Air Toxics Assessment in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the National Air Toxics Assessment database best illustrate the levels of various toxics when aggregated to a national or state level.

USEPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The USEPA Integrated Risk Information System (USEPA 2009b) is a database of human health effects that may result from exposure to various substances found in the environment.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by USEPA, FHWA, and industry, has undertaken a major series of studies to research near roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes – particularly respiratory problems (South Coast Air Quality Management District 2000, The Sierra Club 2004 and Yuhnke 2005). Much of this research is not specific to MSATs, but instead surveys the full spectrum of criteria and other pollutants. These studies do not provide information that would be useful to alleviate the uncertainties listed above to perform a more comprehensive evaluation of the health impacts specific to this project.

Relevance of Unavailable or Incomplete Information

Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emission impacts on human health cannot be made at the project level. While available tools do allow for reasonably predicting relative emissions changes among alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. (As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, it is not possible to make a determination of whether any of the alternatives would have a significant impact due to MSAT emissions.

Emissions would likely be lower than present levels in the design year as a result of USEPA's national control programs that are projected to reduce MSAT emissions by 57% to 87% between 2000 and 2020 (Figure 7.2-2). Local conditions on Guam may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures; however, the magnitude of the USEPA-projected reductions is so great that MSAT emissions are likely to be lower in the future in nearly all cases.

Therefore, although the proposed action may increase exposure to MSAT emissions in certain locations, the concentrations and duration of exposures are uncertain. Because of this uncertainty, the health effects from these emissions cannot be estimated.

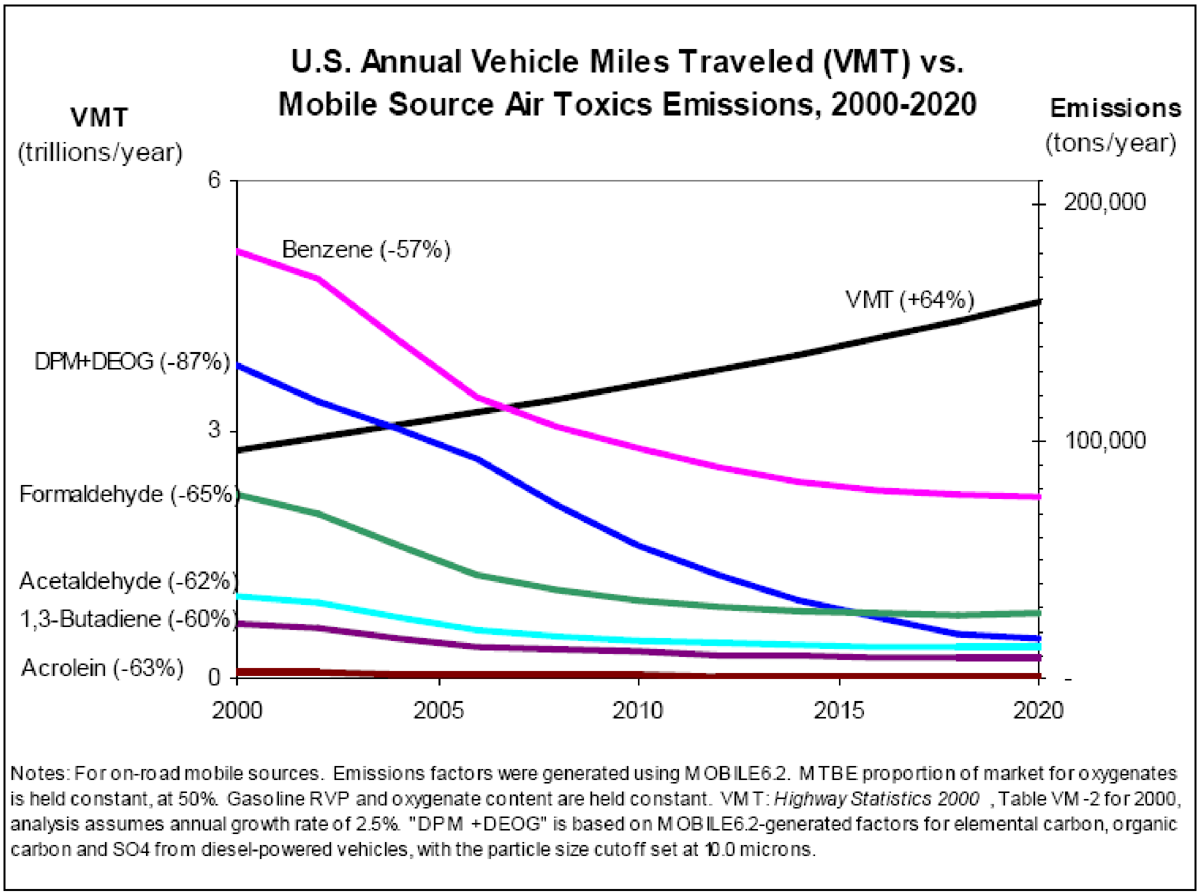

Figure 7.2-2 Projected MSAT Emissions and Traffic Volumes (2000-2020)

Microscale CO Impact Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project examining each ROI. As detailed in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1, 10 North ROI locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Five of these locations failed the screening criteria. The Route 1/28 intersection has the highest overall volume of all the intersections that failed the screening. This site was chosen for detailed analysis. The Route 9/Andersen AFB North Gate intersection was also chosen for analysis due to the extremely high delay predicted in the build scenario and the predicted high volumes at this location. These intersections represent the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from these sites represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-28 and Table 7.2-29 and are described in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1. The values in these tables represent the background CO concentration combined with the modeled results from USEPA's CAL3QHC microscale dispersion model using worst-case meteorological parameters, along with a.m. and p.m. peak traffic data. Emission factors were calculated using USEPA's MOBILE6.2 emission factor program. A background value must be added into the results of the dispersion analysis to account for others sources of CO that are not accounted for in the CAL3QHC modeling. Usually a value from a representative local ambient air quality monitor is used. Guam, however, does not have any local monitoring stations, as discussed earlier in this chapter. Due to this, values from Hawaii were examined to determine their applicability to Guam. Using the 2006-2008 monitored data from the Punchbowl monitor, (rated as a middle scale monitor) located in Honolulu, Hawaii, the second highest maximum 1-hour reading was 1.7 parts ppm. This value was conservatively rounded to 2.0 ppm and represents the background CO concentration for this analysis. A persistence factor, that accounts for hourly variation of traffic and meteorological conditions, of 0.7, as recommended by USEPA was applied to the 1-hour CO concentrations to obtain 8-hour concentrations. As shown in Table 7.2-28 and Table 7.2-29, no violations of the applicable NAAQS are predicted.

Table 7.2-28. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 1

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/28	5.5	6.0	6.9	7.3	6.0	4.2
Route 9/Andersen AFB North Gate	2.3	2.3	2.6	3.1	2.9	2.8

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-29. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North Alternative 1

Analysis Site	*Existing*	*2014*	*2030*
Route 1/28	4.2	5.1	4.2
Route 9/Andersen AFB North Gate	1.6	2.2	2.0

Notes: 8-hour CO NAAQS = 9 ppm Includes a background concentration of 1.4 ppm

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed emission construction analysis was conducted. Using the estimated project schedule, along with typical equipment requirements for specific tasks, emission burden estimates of CO, NO_x, PM_{10}, and $PM_{2.5}$ were calculated. Equipment emissions were presumed to be Tier 3, with high sulfur fuel as confirmed by the construction management team. Based on the preliminary schedule, the highest emissions levels per year, per month, and the year that these emissions are predicted to occur in the North Region are shown in

Table 7.2-30 and also presented in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-30. Estimated Construction Emission Burden – North, Alternative 1

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	13.0	20.3	8.4	4.1	1.4	15.3	3,881
Highest Monthly Emission Burden (Tons)	4.7	7.3	1.8	1.3	0.51	5.4	1,462
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.23	0.36	0.09	0.06	0.03	0.27	73.1
Year Highest Monthly Emission Burden Predicted to Occur	2011	2011	2011	2011	2011	2011	2011

Central

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North ROI Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which Central ROI intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1, 34 locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Twenty-one (21) of these locations failed the screening criteria. The Route 1/8 intersection has the highest overall volume of all the intersections that failed the screening. This site was chosen for detailed analysis. The Route 4/7A intersection has the highest overall delay of any signalized intersection that failed the screening. This site was chosen for detailed analysis. The Route 16/27 intersection fails the screening criteria in other alternatives and was evaluated in this alternative for consistency. These intersections represent the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from these sites represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-31 and Table 7.2-32 and are presented in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1. The values in these tables, using the same analysis techniques and parameters as those applied in the North Region, represent the predicted worst-case CO concentrations. As shown in Table 7.2-31 and Table 7.2-32, no violations of the applicable NAAQS are predicted.

Table 7.2-31. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 1

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/8	6.0	6.4	7.3	7.6	6.2	6.4
Route 4/7A	5.3	3.8	5.1	5.6	4.6	5.1
Route 16/27	8.4	9.4	8.1	9.0	7.0	7.9

Notes: 1-hour CO NAAQS = 35 ppm.Includes a background concentration of 2 ppm.

Table 7.2-32. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 1

Analysis Site	*Existing*	*2014*	*2030*
Route 1/8	4.5	5.3	4.5
Route 4/7A	3.7	3.9	3.6
Route 16/27	6.6	6.3	5.5

Notes: 8-hour CO NAAQS = 9 ppm.Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed emission construction analysis was conducted using the same method as described for the North ROI. The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-33 and also presented in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-33. Estimated Construction Emission Burden – Central, Alternative 1

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	54.6	84.2	17.2	14.4	5.9	62.4	16,707
Highest Monthly Emission Burden (Tons)	8.5	13.1	2.2	2.2	0.9	9.7	2,590
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.42	0.65	0.11	.11	0.05	0.48	129
Year Highest Monthly Emission Burden Predicted to Occur	2012	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013

Apra Harbor

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North ROI, Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1, three locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. One of these locations failed the screening criteria. The Route 1/2A intersection has the highest overall volume and highest delay of all the signalized intersections that failed the screening. This site was chosen for detailed analysis. This intersection represents the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from this site represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-34 and Table 7.2-35 and are presented in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1. The values in these tables, using the same analysis techniques and parameters as those applied in the North Region, represent the predicted worst-case CO concentrations. As shown in Table 7.2-34 and Table 7.2-35, no violations of the applicable NAAQS are predicted.

Table 7.2-34. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 1

Analysis Site	*Existing*		*2014 Alternative 1*		*2030 Alternative 1*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/2A	4.7	4.3	5.3	5.1	4.3	3.9

Notes: 1-hour CO NAAQS = 35 ppm.Includes a background concentration of 2 ppm.

Table 7.2-35. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 1

Analysis Site	*Existing*	*2014 Alternative 1*	*2030 Alternative 1*
Route 1/2A	3.3	3.7	3.0

Notes: 8-hour CO NAAQS = 9 ppm.Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region. The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-36 and presented in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-36. Estimated Construction Emission Burden – Apra Harbor, Alternative 1

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	13.5	20.9	5.0	3.7	1.2	15.4	4,199
Highest Monthly Emission Burden (Tons)	1.6	2.5	0.59	0.44	0.34	1.82	494
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.08	0.12	0.03	.02	0.02	0.0.9	24.7
Year Highest Monthly Emission Burden Predicted to Occur	2011	2011	2011	2011	2011	2011	2011

South

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1, four locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Two of these locations failed the screening criteria. The Route 5/2A intersection has the highest overall volume and highest delay of all the signalized intersections that failed the screening. This site was chosen for detailed analysis. This intersection represents the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from this site represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-37 and Table 7.2-38 and are presented in Volume 9, Appendix I, Section 3.3.7.2 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 1. The values in these tables, using the same analysis techniques and parameters as those applied in the North Region, represent the predicted worst-case CO concentrations. As shown in Table 7.2-37 and Table 7.2-38 no violations of the applicable NAAQS are predicted.

Table 7.2-37. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South, Alternative 1

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 5/2A	4.2	3.9	4.5	4.0	4.0	3.7

Notes: 1-hour CO NAAQS = 35 ppm.Includes a background concentration of 2 ppm.

Table 7.2-38. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South, Alternative 1

Analysis Site	*Existing*	*2014*	*2030*
Route 5/2A	2.9	3.2	2.8

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region. As shown in Table 7.2-39 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions, construction emissions are negligible.

Table 7.2-39. Estimated Construction Emission Burden – South, Alternative 1

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	11.1	17.3	2.9	2.8	1.2	12.9	3310
Highest Monthly Emission Burden (Tons)	3.1	4.9	0.83	0.81	0.34	3.7	957
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.16	0.25	0.04	0.04	0.02	0.18	47.8
Year Highest Monthly Emission Burden Predicted to Occur	2012	2013	2012 & 2013	2012 & 2013	2013	2013	2013

Potential Mitigation Measures

Because the alternative is not predicted to cause a significant impact on air quality levels, no mitigation is proposed.

7.2.6.2 Alternative 2 (Preferred Alternative)

Mesoscale Emissions Burden

As shown in Table 7.2-40 and Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2, regional emissions are predicted to increase in the range of 18% to 19% under Alternative 2 and are the same as compared to Alternative 1. This is primarily due to the estimated 18% increase in VMT under Alternative 2.

Table 7.2-40. Regional Annual Emission Burdens, Alternative 2

Scenario	*VMT*	*Speed*	*Emission Burden (tpy)*						
			CO	*NO_x*	*VOC*	*PM_{10}*	*$PM_{2.5}$*	*SO_2*	*CO_2*
2030 Alternative 2	4,160,544	28.0	15,813	566	951	91	67	661	94,687,2

Legend: CO = carbon monoxide; VOC = volatile organic compounds; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; tpy = tons per year; NOx = nitrogen oxides; VMT = vehicle miles traveled.

North

Mobile Source Air Toxics

MSAT impacts would be the same as those discussed for the North Region under Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2, 10 locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Five of these locations failed the screening criteria. The Route 1/28 intersection has the highest overall volume of all the intersections that failed the screening. This site was chosen for detailed analysis. The Route 9/Andersen AFB North Gate intersection was also chosen for analysis due to the extremely high delay predicted in the build scenario and the predicted high volumes at this location. These intersections represent the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from these sites represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-41 and Table 7.2-42 and are presented in Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2. The values in these tables, using the same analysis techniques and parameters as those applied in the North Region under Alternative 1, represent the predicted worst-case CO concentrations. As shown in Table 7.2-41 and Table 7.2-42, no violations of the applicable NAAQS are predicted.

Table 7.2-41. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 2

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/28	5.5	6.0	6.9	7.3	6.0	4.2
Route 9/Andersen AFB North Gate	2.3	2.3	2.6	3.1	2.9	2.8

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-42. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North Region, Alternative 2

Analysis Site	*Existing*	*2014*	*2030*
Route 1/28	4.2	5.1	4.2
Route 9/Andersen AFB North Gate	1.6	2.2	2.0

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region (Alternative 1). The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-43 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions. These emissions were further combined with those from other project components and discussed in Volume 7 to determine the potential impact significance.

Table 7.2-43. Estimated Construction Emission Burden – North, Alternative 2

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	13.0	20.3	8.4	4.1	1.4	15.3	3,881
Highest Monthly Emission Burden (Tons)	4.7	7.3	1.8	1.3	0.51	5.4	1,462
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.23	0.36	0.09	0.06	0.03	0.27	73.1
Year Highest Monthly Emission Burden Predicted to Occur	2011	2011	2011	2011	2011	2011	2011

Central

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region under Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2, 34 locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Twenty-one (21) of these locations failed the screening criteria. The Route 1/8 intersection has the highest overall volume of all the intersections that failed the screening. This site was chosen for detailed analysis. The Route 4/7A intersection has the highest overall delay of any signalized intersection that failed the screening. This site was chosen for detailed analysis. The Route 16/27 intersection fails the screening criteria in other alternatives and was evaluated in this alternative for consistency. These intersections represent the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from these sites represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-44 and Table 7.2-45 and are presented in Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2. The values in these tables, using the same analysis techniques and parameters as those applied in the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-44 and Table 7.2-45, no violations of the applicable NAAQS are predicted.

Table 7.2-44. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 2

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/8	6.0	6.4	7.3	7.6	6.2	6.4
Route 4/7A	5.3	3.8	5.1	5.6	4.6	5.1
Route 16/27	8.4	9.4	8.1	9.0	7.0	7.9

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-45. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 2

Analysis Site	*Existing*	*2014*	*2030*
Route 1/8	4.5	5.3	4.5
Route 4/7A	3.7	3.9	3.6
Route 16/27	6.6	6.3	5.5

Notes: 8-hour CO NAAQS = 9 ppm.Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed emission construction analysis was conducted using the same method as described for the North Region (Alternative 1). The highest emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-46 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions. These emissions were further combined with those from other project components and discussed in Volume 7 to determine the potential impact significance.

Table 7.2-46. Estimated Construction Emission Burden – Central, Alternative 2

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	54.6	84.2	17.2	14.4	5.9	62.4	16,707
Highest Monthly Emission Burden (Tons)	8.5	13.1	2.2	2.2	0.9	9.7	2,590
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.42	0.65	0.11	.11	0.05	0.48	129
Year(s) Highest Monthly Emission Burden Predicted to Occur	2012	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013

Apra Harbor

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region under Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2, three locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. One of these locations failed the screening criteria. The Route 1/2A intersection has the highest overall volume and highest delay of all the signalized intersections that failed the screening. This site was chosen for detailed analysis. This intersection represents the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from this site represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-47 and Table 7.2-48 and are presented in Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2. The values in these tables, using the same analysis techniques and parameters as those applied in the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-47 and Table 7.2-48, no violations of the applicable NAAQS are predicted.

Table 7.2-47. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 2

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/2A	4.7	4.3	5.3	5.1	4.3	3.9

Notes: 1-hour CO NAAQS = 35 ppm.Includes a background concentration of 2 ppm.

Table 7.2-48. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 2

Analysis Site	*Existing*	*2014*	*2030*
Route 1/2A	3.3	3.7	3.0

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region (Alternative 1). The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-49 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions. These emissions were further combined with those from other project components and discussed in Volume 7 to determine the potential impact significance.

Table 7.2-49. Estimated Construction Emission Burden – Apra Region, Alternative 2

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	13.5	20.9	5.0	3.7	1.2	15.4	4,199
Highest Monthly Emission Burden (Tons)	1.6	2.5	0.59	0.44	0.34	1.82	494
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.08	0.12	0.03	.02	0.02	0.0.9	24.7
Year Highest Monthly Emission Burden Predicted to Occur	2011	2011	2011	2011	2011	2011	2011

<u>South</u>

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region, Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2, four locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Two of these locations failed the screening criteria. The Route 5/2A intersection has the highest overall volume and highest delay of all the signalized intersections that failed the screening. This site was chosen for detailed analysis. This intersection represents the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from this site represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-50 and Table 7.2-51 and are presented in Volume 9, Appendix I, Section 3.3.7.3 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 2. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-50 and Table 7.2-51, no violations of the applicable NAAQS are predicted.

Table 7.2-50. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South, Alternative 2

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 5/2A	4.2	3.9	4.5	4.0	4.0	3.7

Notes: 1-hour CO NAAQS = 35 ppm.Includes a background concentration of 2 ppm.

Table 7.2-51. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South, Alternative 2

Analysis Site	*Existing*	*2014*	*2030*
Route 5/2A	2.9	3.2	2.8

Notes: 8-hour CO NAAQS = 9 ppm.Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region (Alternative 1). As shown in Table 7.2-52 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions, construction emissions are negligible.

Table 7.2-52. Estimated Construction Emission Burden – South, Alternative 2

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	11.1	17.3	2.9	2.8	1.2	12.9	3310
Highest Monthly Emission Burden (Tons)	3.1	4.9	0.83	0.81	0.34	3.7	957
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.16	0.25	0.04	0.04	0.02	0.18	47.8
Year Highest Monthly Emission Burden Predicted to Occur	2012	2013	2012 & 2013	2012 & 2013	2013	2013	2013

Potential Mitigation Measures

Because the alternative is not predicted to cause a significant impact on air quality levels, no mitigation is proposed.

7.2.6.3 Alternative 3

Mesoscale Emissions Burden

As shown in Table 7.2-53 and presented in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3, regional emissions are predicted to increase in the range of 20% to 23% under Alternative 3, as compared to the no-action alternative. This is primarily due to the estimated 20% increase in VMT under Alternative 3.

Table 7.2-53. Regional Annual Emission Burdens, Alternative 3

Scenario	*VMT*	*Speed*	*Emission Burden (tpy)*						
			CO	*NOx*	*VOC*	*PM_{10}*	*$PM_{2.5}$*	*SO_2*	*CO_2*
2030 No-Action Alternative	3,535,224	28.6	13,388	478	801	78	57	562	80,499
2030 Alternative 2	4,249,190	27.4	16,211	580	982	93	68	675	96,705
Net Change from No-Action			2,823	102	181	15	11	113	16,206
Percent Change from No-Action			21%	21%	23%	20%	20%	20%	20%

Legend: CO = carbon monoxide; VOC = volatile organic compounds; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; tpy = tons per year; NOx = nitrogen oxides; VMT = vehicle miles traveled.

North

Mobile Source Air Toxics

FHWA requires quantitative emissions analysis for projects that involve new or additional capacity on roadways where the traffic volume would be 140,000 to 150,000 average annual daily traffic (AADT). The 2030 average daily traffic (ADT) estimates for the three most traveled roadways under Alternative 3 are shown in Table 7.2-54 and Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3. Since the ADTs are less than 140,000 for the design year, a MSAT analysis is not required.

Table 7.2-54. Average Daily Traffic for Major Roadways, Alternative 3

Roadway	*Alternative 3 No Build*	*Alternative 3 Build*
Route 1	95,100	93,100
Route 8	59,000	60,400
Route 18	83,600	89,200

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3, 10 locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Nine of these locations failed the screening criteria. The Route 1/28 intersection has the highest overall volume of all the intersections that failed the screening. This site was chosen for detailed analysis. The Route 9/Andersen AFB North Gate intersection was also chosen for analysis due to the extremely high delay predicted in the build scenario and the predicted high volumes at this location. These intersections represent the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from these sites represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-55 and Table 7.2-56 and are presented in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-55 and Table 7.2-56, no violations of the applicable NAAQS are predicted.

Table 7.2-55. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 3

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/28	5.5	6.0	7.1	7.5	5.6	5.9
Route 9/Andersen AFB North Gate	2.3	2.3	2.7	3.3	2.9	2.8

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-56. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North, Alternative 3

Analysis Site	*Existing*	*2014*	*2030*
Route 1/28	4.2	5.3	4.1
Route 9/Andersen AFB North Gate	1.6	2.3	2.0

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region under Alternative 1. The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-57 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-57. Estimated Construction Emission Burden – North, Alternative 3

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	13.0	20.3	8.4	4.1	1.4	15.3	3,881
Highest Monthly Emission Burden (Tons)	4.7	7.3	1.8	1.3	0.51	5.4	1,462
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.23	0.36	0.09	0.06	0.03	0.27	73.1
Year Highest Monthly Emission Burden Predicted to Occur	2011	2011	2011	2011	2011	2011	2011

<u>Central</u>

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region under Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3, 34 locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Twenty-eight of these locations failed the screening criteria. The Route 16/27 intersection has the highest overall volume of all the intersections that failed the screening. This site was chosen for detailed analysis. The Route 4/7A intersection has the highest overall delay of any signalized intersection that failed the screening. This site was chosen for detailed analysis. These intersections represent the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from these sites represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-58 and Table 7.2-59 and are presented in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-58 and Table 7.2-59 no violations of the applicable NAAQS are predicted.

Table 7.2-58. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 3

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/8	6.0	6.4	7.3	7.6	6.2	6.4
Route 4/7A	5.3	3.8	5.1	5.6	4.6	5.1
Route 16/27	8.4	9.4	8.1	9.0	7.0	7.9

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-59. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 3

Analysis Site	*Existing*	*2014*	*2030*
Route 1/8	4.5	5.3	4.5
Route 4/7A	3.7	3.9	3.6
Route 16/27	6.6	6.3	5.5

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region (Alternative 1). The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-60 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-60. Estimated Construction Emission Burden – Central, Alternative 3

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	54.6	84.2	17.2	14.4	5.9	62.4	16,707
Highest Monthly Emission Burden (Tons)	8.5	13.1	2.2	2.2	0.9	9.7	2,590
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.42	0.65	0.11	.11	0.05	0.48	129
Year(s) Highest Monthly Emission Burden Predicted to Occur	2012	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013

Apra Harbor

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region under Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3, three locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. One of these locations failed the screening criteria. The Route 1/2A intersection has the highest overall volume and highest delay of all the signalized intersections that failed the screening. This site was chosen for detailed analysis. This intersection represents the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from this site represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-61 and Table 7.2-62 and are presented in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-61 and Table 7.2-62 no violations of the applicable NAAQS are predicted.

Table 7.2-61. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 3

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/2A	4.7	4.3	5.3	5.1	4.3	3.8

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-62. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 3

Analysis Site	*Existing*	*2014*	*2030*
Route 1/2A	3.3	3.7	3.0

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region (Alternative 1). The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-63 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-63. Estimated Construction Emission Burden – Apra Harbor, Alternative 3

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	13.5	20.9	5.0	3.7	1.2	15.4	4,199
Highest Monthly Emission Burden (Tons)	1.6	2.5	0.59	0.44	0.34	1.82	494

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.08	0.12	0.03	.02	0.02	0.0.9	24.7
Year Highest Monthly Emission Burden Predicted to Occur	2011	2011	2011	2011	2011	2011	2011

South

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region under Alternative 1.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3, four locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Two of these locations failed the screening criteria. The Route 5/2A intersection has the highest overall volume of all the signalized intersections that failed the screening. This site was chosen for detailed analysis. This intersection represents the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from this site represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-64 and Table 7.2-65 and are presented in Volume 9, Appendix I, Section 3.3.7.4 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 3. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations As shown in Table 7.2-64 and Table 7.2-65, no violations of the applicable NAAQS are predicted.

Table 7.2-64. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South, Alternative 3

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 5/2A	4.2	3.9	4.5	3.9	3.8	3.5

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-65. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South, Alternative 3

Analysis Site	*Existing*	*2014*	*2030*
Route 5/2A	2.9	3.2	2.7

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region (Alternative 1). As shown in Table 7.2-66 and Volume 9, Appendix I, Section 3.4 Construction Activity

Emissions, construction emissions are negligible.

Table 7.2-66. Estimated Construction Emission Burden – South, Alternative 3

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	11.1	17.3	2.9	2.8	1.2	12.9	3310
Highest Monthly Emission Burden (Tons)	3.1	4.9	0.83	0.81	0.34	3.7	957
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.16	0.25	0.04	0.04	0.02	0.18	47.8
Year(s) Highest Monthly Emission Burden Predicted to Occur	2012	2013	2012 & 2013	2012 & 2013	2013	2013	2013

Potential Mitigation Measures

Because the alternative is not predicted to cause a significant impact on air quality levels, no mitigation is proposed.

7.2.6.4 Alternative 8

Mesoscale Emissions Burden

As shown in Table 7.2-67 and Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8 regional emissions are predicted to increase in the range of 19% to 21% under Alternative 8, as compared to the no-action alternative. This is primarily due to the estimated 20% increase in VMT under Alternative 8.

Table 7.2-67. Regional Annual Emission Burdens, Alternative 8

Scenario	*VMT*	*Speed*	*Emission Burden (tpy)*						
			CO	*NO_x*	*VOC*	*PM_{10}*	*$PM_{2.5}$*	*SO_2*	*CO_2*
2030 No-Action Alternative	3,535,224	28.6	13,388	478	801	78	57	562	80,499
2030 Alternative 8	4,247,334	28.0	16,143	578	971	93	68	675	96,662
Net Change from No-Action			2,755	100	170	15	11	113	16,163
Percent Change from No-Action			21%	21%	21%	19%	19%	20%	20%

Legend: CO = carbon monoxide; VOC = volatile organic compounds; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; tpy = tons per year; NOx = nitrogen oxides;
VMT = vehicle miles traveled.

North

Mobile Source Air Toxics

FHWA requires quantitative emissions analysis for projects that involve new or additional capacity on roadways where the traffic volume would be 140,000 to 150,000 average annual daily traffic (AADT). The 2030 average daily traffic (ADT) estimates for the three most traveled roadways under Alternative 8 are shown in Table 7.2-68 and Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8. Since the ADTs are less than 140,000 for the design year, a MSAT analysis is not required.

Table 7.2-68. Average Daily Traffic for Major Roadways, Alternative 8

Roadway	Alternative 8 No Build	Alternative 8 Build
Route 1	96,100	95,300
Route 8	58,800	59,700
Route 18	75,100	75,100

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8, 10 locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Five of these locations failed the screening criteria. The Route 1/28 intersection has the highest overall volume of all the intersections that failed the screening. This site was chosen for detailed analysis. The Route 9/Andersen AFB North Gate intersection was also chosen for analysis due to the extremely high delay predicted in the build scenario and the predicted high volumes at this location. These intersections represent the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from these sites represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-69 and Table 7.2-70 and are presented in Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-69 and Table 7.2-70, no violations of the applicable NAAQS are predicted.

Table 7.2-69. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 8

Analysis Site	Existing		2014		203	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
Route 1/28	5.5	6.0	7.1	7.4	5.8	5.7
Route 9/Andersen AFB North Gate	2.3	2.3	2.6	3.1	2.9	2.8

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-70. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North, Alternative 8

Analysis Site	Existing	2014	2030
Route 1/28	4.2	5.2	4.1
Route 9/Andersen AFB North Gate	1.6	2.2	2.0

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted. Using the estimated project schedule along with typical equipment requirements for specific tasks, emission burden estimates of CO, NO_x, PM_{10}, and $PM_{2.5}$ were calculated. Equipment emissions were presumed to be Tier 3, with high sulfur fuel as confirmed by the construction management team. Based on the preliminary schedule, the highest emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-71 and Volume 9,

Appendix I, Section 3.4 Construction Activity Emissions

Table 7.2-71. Estimated Construction Emission Burden – North, Alternative 8

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	13.0	20.3	8.4	4.1	1.4	15.3	3,881
Highest Monthly Emission Burden (Tons)	4.7	7.3	1.8	1.3	0.51	5.4	1,462
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.23	0.36	0.09	0.06	0.03	0.27	73.1
Year Highest Monthly Emission Burden Predicted to Occur	2011	2011	2011	2011	2011	2011	2011

<u>Central</u>

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8, 34 locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. Twenty of these locations failed the screening criteria. The Route 16/27 intersection has the third highest overall volume and the worst delay of the three highest volume intersections. This site was chosen for detailed analysis. The Route 4/7A intersection has the highest overall delay of any signalized intersection that failed the screening. This site was chosen for detailed analysis. These intersections represent the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from these sites represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-72 and Table 7.2-73 and are presented in Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in in Table 7.2-72 and Table 7.2-73, no violations of the applicable NAAQS are predicted.

Table 7.2-72. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 8

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/8	6.0	6.4	7.3	7.4	5.6	6.0
Route 4/7A	5.3	3.8	5.2	5.3	4.6	5.0
Route 16/27	8.4	9.4	8.3	9.4	7.1	8.0

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-73. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 8

Analysis Site	*Existing*	*2014*	*2030*
Route 1/8	4.5	5.2	4.2
Route 4/7A	3.7	3.7	3.5
Route 16/27	6.6	6.6	5.6

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region (Alternative 1). The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-74 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-74. Estimated Construction Emission Burden – Central, Alternative 8

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	54.6	84.2	17.2	14.4	5.9	62.4	16,707
Highest Monthly Emission Burden (Tons)	8.5	13.1	2.2	2.2	0.9	9.7	2,590
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.42	0.65	0.11	.11	0.05	0.48	129
Year Highest Monthly Emission Burden Predicted to Occur	2012	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013	2012 & 2013

Apra Harbor

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8, three locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. One of these locations failed the screening criteria. The Route 1/2A intersection has the highest overall volume and highest delay of all the signalized intersections that failed the screening. This site was chosen for detailed analysis. This intersection represents the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from this site represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-75 and Table 7.2-76 and are presented in Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-75 and Table 7.2-76, no violations of the applicable NAAQS are predicted.

Table 7.2-75. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 8

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 1/2A	4.7	4.3	5.3	5.1	4.3	3.9

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-76. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 8

Analysis Site	*Existing*	*2014*	*2030*
Route 1/2A	3.3	3.7	3.0

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed construction emissions analysis was conducted using the same method as described for the North Region (Alternative 1). The highest predicted construction emissions per year, per month, and the year that these emissions are predicted to occur are shown in Table 7.2-77 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

Table 7.2-77. Estimated Construction Emission Burden – Apra Harbor, Alternative 8

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	13.5	20.9	5.0	3.7	1.2	15.4	4,199
Highest Monthly Emission Burden (Tons)	1.6	2.5	0.59	0.44	0.34	1.82	494
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.08	0.12	0.03	.02	0.02	0.0.9	24.7
Year Highest Monthly Emission Burden Predicted to Occur	2011	2011	2011	2011	2011	2011	2011

<u>South</u>

Mobile Source Air Toxics

MSAT impacts would be the same as those for the North Region.

Microscale CO Analysis

A screening analysis was performed to determine which intersections could potentially degrade air quality levels due to increased delay, volume, or worsening LOS due to the project. As detailed in and Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for Alternative 8 four locations were screened based on changes in intersection volumes, delay, and LOS between the no-action and build alternatives. One of these locations failed the screening criteria. The Route 5/2A intersection has the highest overall volume of all the signalized intersections that failed the screening. This site was chosen for detailed analysis. This intersection represents the worst-case combination of volumes, LOS, and delay of the intersections screened. As such, the predicted CO levels from this site represent the worst-case microscale CO impacts expected from the project.

The results of the microscale analysis are shown in Table 7.2-78 and Table 7.2-79 and are presented in Volume 9, Appendix I, Section 3.3.7.5 Off Base On-road Vehicle Operational Emissions and Impact for

Alternative 8. The values in these tables, using the same analysis techniques and parameters as those applied for the North Region (Alternative 1), represent the predicted worst-case CO concentrations. As shown in Table 7.2-78 and Table 7.2-79 no violations of the applicable NAAQS are predicted.

Table 7.2-78. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South Region, Alternative 8

Analysis Site	*Existing*		*2014*		*2030*	
	a.m.	*p.m.*	*a.m.*	*p.m.*	*a.m.*	*p.m.*
Route 5/2A	4.2	3.9	4.5	4.0	3.9	3.7

Notes: 1-hour CO NAAQS = 35 ppm. Includes a background concentration of 2 ppm.

Table 7.2-79. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South Region, Alternative 8

Analysis Site	*Existing*	*2014*	*2030*
Route 5/2A	2.9	3.2	2.7

Notes: 8-hour CO NAAQS = 9 ppm. Includes a background concentration of 1.4 ppm.

Construction Emissions Analysis

To determine the temporary air quality impacts arising from construction of the project, a detailed emission construction analysis was conducted using the same method as described for the North Region (Alternative 1). As shown in Table 7.2-80 and Volume 9, Appendix I, Section 3.4 Construction Activity Emissions, construction emissions are negligible.

Table 7.2-80. Estimated Construction Emission Burden – South, Alternative 8

	CO	*NO_x*	*PM_{10}*	*$PM_{2.5}$*	*VOC*	*SO_2*	*CO_2*
Maximum Yearly Value (Tons)	11.1	17.3	2.9	2.8	1.2	12.9	3310
Highest Monthly Emission Burden (Tons)	3.1	4.9	0.83	0.81	0.34	3.7	957
Average Daily Emission Burden (Based on Highest Month) (Tons)	0.16	0.25	0.04	0.04	0.02	0.18	47.8
Year Highest Monthly Emission Burden Predicted to Occur	2012	2013	2012 & 2013	2012 & 2013	2013	2013	2013

Potential Mitigation Measures

Because the alternative is not predicted to cause a significant impact on air quality levels, no mitigation is proposed.

7.2.6.5 Summary of Impacts

Table 7.2-81 summarizes the potential air quality impacts associated with each of the roadway project alternatives.

Construction activities for all alternatives would result in less than a significant impact to air quality resources because the roadway construction associated emissions were predicted to be below the significance criterion of 250 TPY.

The proposed project would increase regional operation VMT by approximately 18% to 20%, compared to the no-action alternative. This would increase regional pollutant levels (i.e., CO, HC, PM_{10}, $PM_{2.5}$,

NO_x) under the build alternatives by approximately 18% to 23%. However, the predicted operational emissions would be below the significance criteria of 250 TPY with an exception of CO under each alternative. However, since the 250 TPY threshold is selected in the context of the *de minimis* threshold established in the CAA general conformity rule providing only an indication of potential significant impact, a formal impact analysis was conducted with respect toe potenital CO impact. Based on a refined CO concentration modeling analysis for on road vehicle operational impact described in this volume, no exceedances of the CO NAAQS were predicted at the location of anticipated highest emissions. Therefore, each proposed alternative would not result in a significant CO impact even though the regional emissions would exceed 250 TPY. Consequently, the proposed alternatives would result in a less than significant impact on air quality.

MSAT levels are also predicted to increase under the build alternatives compared to the no-action alternative. However, given future reductions in overall MSAT levels due to USEPA-mandated regulations, projected MSAT levels, even with the predicted VMT increases under the build alternatives, are expected to be lower than they are today and would result in a less than significant MSAT impact.

Table 7.2-81. Summary of Potential Impacts to Air Quality -Roadway Projects

Potentially Impacted Resource	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 8*
Regional Air Quality	LSI	LSI	LSI	LSI
Mobile Source Air Toxics	LSI	LSI	LSI	LSI
Local Carbon Monoxide Levels	LSI	LSI	LSI	LSI
Air Quality during Construction	LSI	LSI	LSI	LSI

Legend: LSI = Less than significant impact.

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