3.7 GREENHOUSE GAS EMISSIONS

This section describes the existing physical affected environment and regulatory framework related to climate change and greenhouse gas (GHG) emissions and discusses the potential effects of the EIS Alternatives related to GHG emissions and climate change.

3.7.1 Affected Environment

Greenhouse Effect, Global Warming, and Climate Change

Most of the energy that affects Earth's climate comes from the sun. Some solar radiation is absorbed by Earth's surface, and a smaller portion of this radiation is reflected by the atmosphere back toward space. As Earth absorbs high-frequency solar radiation, its surface gains heat and then re-radiates lower frequency infrared radiation back into the atmosphere.[1] Most solar radiation passes through gases in the atmosphere classified as GHGs; however, infrared radiation is selectively absorbed by GHGs. GHGs in the atmosphere play a critical role in maintaining the balance between earth's absorbed and radiated energy, earth's radiation budget,[2] by trapping some of the infrared radiation emitted from Earth's surface that otherwise would have escaped to space (Figure 3.7-1). Specifically, GHGs affect the radiative forcing of the atmosphere,[3] which in turn affects Earth's average surface temperature. This phenomenon, the *greenhouse effect*, keeps the earth's atmosphere near the surface warmer than it would be otherwise and allows successful habitation by humans and other forms of life.

The combustion of fossil fuels and deforestation release carbon that historically has been stored underground in sediments or in surface vegetation into the atmosphere, thus exchanging carbon from the geosphere and biosphere to the atmosphere within the carbon cycle. With the accelerated increase of fossil fuel combustion and deforestation since the industrial revolution of the 19th century, concentrations of GHGs have increased exponentially in the atmosphere. Such emissions of GHGs in excess of natural ambient concentrations contribute to the enhancement of the natural greenhouse effect. This enhanced greenhouse effect has contributed to *global warming*, an increased rate of warming of the earth's average surface temperature.[4] Specifically, increases in GHGs lead to increased absorption of infrared radiation by Earth's atmosphere and warm the lower atmosphere further, thereby increasing temperatures and evaporation rates near the surface. Variations in natural phenomena such as volcanoes and solar activity produced most of the global temperature increase during preindustrial times; however, increasing atmospheric GHG concentrations resulting from human activity have been responsible for most of the observed global temperature increase.[5]

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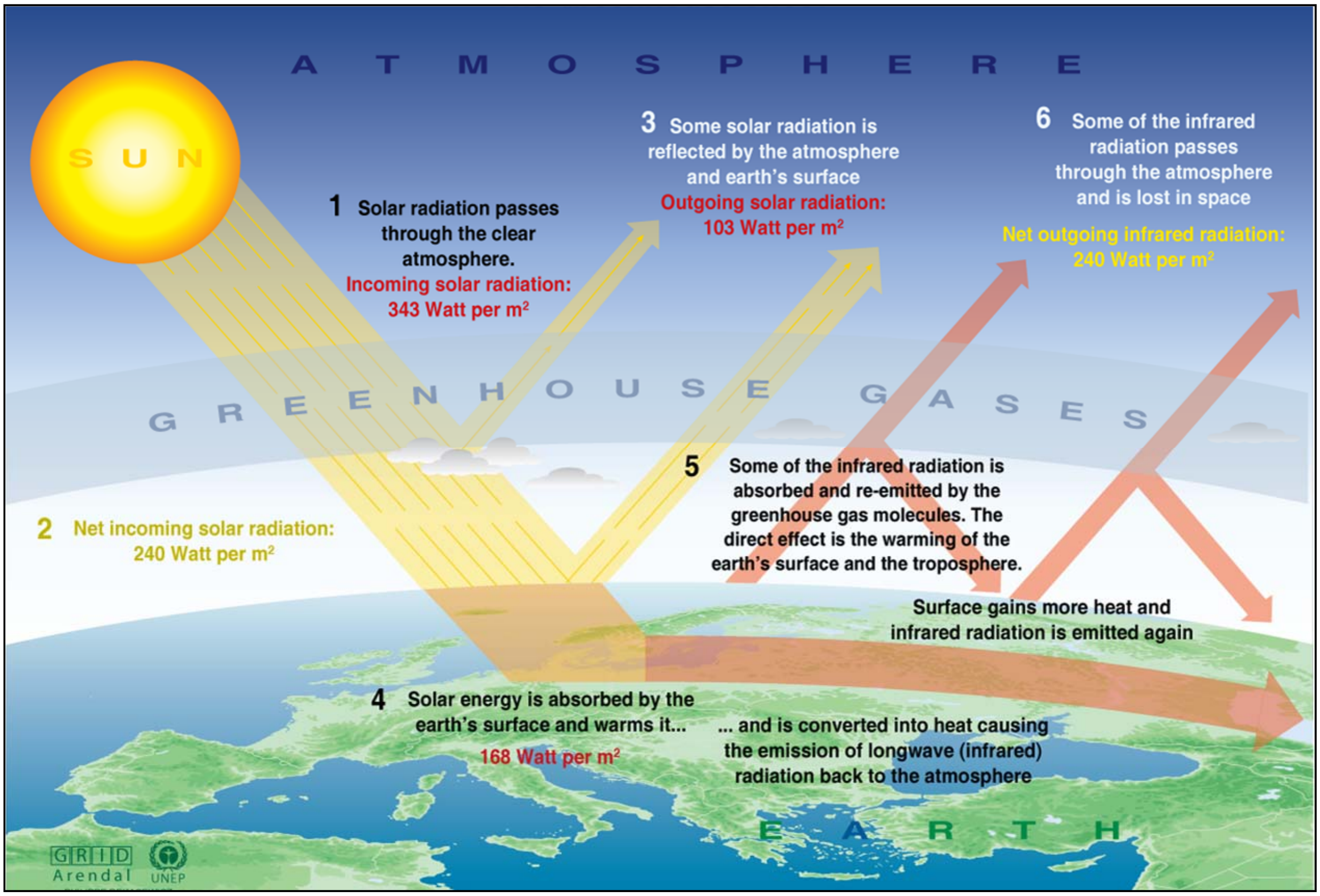
1 Frequencies at which bodies emit radiation are proportional to temperature. Earth has a much lower temperature than the sun and emits lower frequency (longer wavelength) radiation, compared to the high-frequency (short wavelength) solar radiation emitted by the sun.

2 This includes all gains of incoming energy and all losses of outgoing energy; the planet is always striving to be in equilibrium.

3 This is the change in net irradiance at the tropopause after allowing for stratospheric temperatures to readjust to radiative equilibrium, but with surface and tropospheric temperatures and state held fixed at the unperturbed values.

4 This is the result of Earth having to work harder to maintain its radiation budget, because (under the condition of more GHGs in the atmosphere) Earth must force emission of additional infrared radiation out into the atmosphere.

5 These basic conclusions have been endorsed by more than 45 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries. Since 2007, no scientific body of national or international standing has maintained a dissenting opinion.



Source: UNEP/GRID-Arendal, 2005

Figure 3.7-1: The Greenhouse Effect

Global warming affects global atmospheric circulations and temperatures, oceanic circulations and temperatures, wind and weather patterns, average sea level, ocean acidification, chemical reaction rates, precipitation rates, timing, and form, snowmelt timing and runoff flow, water supply, wildfire risks, and other phenomena in a manner commonly referred to as *climate change*.

Intergovernmental Panel on Climate Change Temperature Prediction

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical, and socioeconomic information relevant to the understanding of climate change, its potential impacts, and options for adaptation and mitigation. Warming of the climate system is now considered to by unequivocal (IPCC, 2007a) with global surface temperature increasing approximately 1.33 degrees Fahrenheit (°F) over the last 100 years. The IPCC predicts increases in global average temperature globally of between 2° and 11°F over the next 100 years (depending on scenario) (IPCC, 2007b).

Greenhouse Gases and Global Emission Sources

Prominent naturally occurring GHGs in Earth's atmosphere are water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Anthropogenic (i.e., human-caused) emissions include additional release of these GHGs plus release of human-made, high global warming potential gases (HGWPGs) (sulfur hexafluoride [SF_6], perfluorocarbons [PFCs], hydrofluorocarbons [HFCs], and ozone-depleting substances [ODSs]) into Earth's atmosphere. The GHGs listed by the IPCC (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) are discussed below, in order of abundance in the atmosphere. Water vapor, although the most abundant GHG, is not discussed below, because natural concentrations and fluctuations far outweigh anthropogenic influences, making it impossible to predict. Ozone is not included because it does not directly affect radiative forcing. ODSs, which include chlorofluorocarbons (CFCs), halons, carbon tetrachloride, methyl chloroform, and hydrochlorofluorocarbons (HCFCs), are not included because they have been primarily replaced by HFCs and PFCs.

GHGs have different potentials for contributing to global warming. For example, methane is 21 times as potent as carbon dioxide, while sulfur hexafluoride is 22,200 times more potent than carbon dioxide. To simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the global warming potential (GWP) methodology defined in the IPCC reference documents (IPCC, 2001). The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of carbon dioxide equivalents (CO_2e), which compares the gas in question to that of the same mass of CO_2 (CO_2 has a GWP of 1 by definition). As such, a high GWP represents high infrared radiation absorption and long atmospheric lifetime compared to CO_2. One must also select a time horizon to convert GHG emissions to equivalent CO_2 emissions to account for chemical reactivity and lifetime differences among various GHG species. The standard time horizon for climate change analysis is 100 years. Generally, GHG emissions are quantified in terms of metric tons (MT) of CO_2e emitted per year.

The atmospheric residence time of a gas is equal to the total atmospheric abundance of the gas divided by its rate of removal (Seinfeld and Pandis, 2006). The atmospheric residence time of a gas is in effect a half-life measurement of how long a gas is expected to persist in the atmosphere when taking into account removal mechanisms such as chemical transformation and deposition.

Table 3.7-1 lists the GWP of each GHG, its lifetime, and abundance in the atmosphere in parts per trillion (ppT). Units commonly used to describe the concentration of GHGs in the atmosphere are parts per million (ppm), parts per billion (ppb), and parts per trillion (ppT), referring to the number of molecules of the GHG in a sampling of 1 million, 1 billion, or 1 trillion molecules of air. Collectively, HFCs, PFCs, and SF_6 are referred to as HGWPGs. CO_2 is by far the largest component of worldwide CO_2e emissions, followed by CH_4, N_20, and HGWPGs in order of decreasing contribution to CO_2e.

The primary human processes that release GHGs include burning of fossil fuels for transportation, heating, and electricity generation; agricultural practices that release methane such as livestock grazing and crop residue decomposition; and industrial processes that release smaller amounts of HGWPGs. Deforestation and land cover conversion have also been identified as contributing to global warming by reducing Earth's capacity to remove CO_2 from the air and altering Earth's albedo or surface reflectance, allowing more solar radiation to be absorbed. Specifically, CO_2 emissions associated with fossil fuel combustion are the primary contributors to human-induced climate change. CO_2, CH_4, and N_2O emissions associated with human activities are the next largest contributors to climate change. Table 3.7-2 lists the anthropogenic contribution of GHGs in terms of CO_2e for the year 2004.

Table 3.7-1: Lifetimes, Global Warming Potentials, and Abundances of Significant Greenhouse Gases

Gas	Global Warming Potential (100 years)	Lifetime (years)	1998 Atmospheric Abundance (ppT[1])
CO_2	1	50–200	365,000,000
CH_4	21	9–15	1,745
N_2O	310	120	314
HFC-23	11,700	264	14
HFC-134a	1,300	14.6	7.5
HFC-152a	140	1.5	0.5
CF_4	6,500	50,000	80
C_2F_6	9,200	10,000	3
SF_6	23,900	3,200	4.2

Notes:
C_2F_6 = hexafluoroethane; CF_4 = tetrafluoromethane; CH_4 = methane; CO_2 = carbon dioxide; HFC = hydrofluorocarbon; N_2O = nitrous oxide; SF_6 = sulfur hexafluoride
Tetrafluoromethane and hexafluoroethane are perfluorocarbons.
[1] ppT is a mixing ratio unit indicating the concentration of a pollutant in parts per trillion by volume.
Sources: IPCC, 1996, 2001

Table 3.7-2: Global Anthropogenic Greenhouse Gas Emissions in 2004 (CO_2 Equivalent)

Gas	Source	GHG Emissions (Gt CO_2e/year)	CO_2 Equivalent Percentage
CO_2	Deforestation, decay of biomass, etc.	8.5	17.3
CO_2	Fossil fuel use	27.7	56.6
CO_2	Other	1.4	2.8
CH_4	Agriculture, natural gas combustion, coal mining, etc.	7.0	14.3
N_2O	Agriculture, industry, transportation, etc.	3.9	7.9
High GWP gases (includes HFCs, PFCs, and SF_6)	Consumer products, refrigerants, aluminum production, semiconductor manufacturing	0.5	1.1
All GHGs		49.0	100

Notes:
CH_4 = methane; CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; Gt = gigatonnes; GWP = global warming potential; HFC = hydrofluorocarbon; N_2O = nitrous oxide; PFC = perfluorocarbon; SF_6 = sulfur hexafluoride
Sources: Olivier et al., 2005, 2006 in IPCC, 2007c

Carbon Dioxide

CO_2 is the most important anthropogenic GHG and accounts for more than 75 percent of all anthropogenic GHG emissions. Its long atmospheric lifetime (on the order of decades to centuries) ensures that atmospheric concentrations of CO_2 will remain elevated for decades after GHG mitigation efforts to reduce GHG concentrations are promulgated (Olivier et al., 2005, 2006 in IPCC, 2007c).

Increasing concentrations of CO_2 in the atmosphere are largely attributable to emissions from the burning of fossil fuels, gas flaring, cement production, and land use changes. Three-quarters of the current radiative forcing is likely due to anthropogenic CO_2 emissions that are the result of fossil fuel burning (and to a very small extent, cement production), and approximately one-quarter of the current radiative forcing is the result of land-use change (IPCC, 2007d).

Anthropogenic emissions of CO_2 have increased concentrations in the atmosphere most notably since the Industrial Revolution; the concentration of CO_2 has increased from approximately 280 to 379 ppm over the last 250 years, an increase of over 35 percent (IPCC, 2007d). IPCC estimates that the present atmospheric concentration of CO_2 has not been exceeded in the last 650,000 years and is likely to be the highest ambient concentration in the last 20 million years (IPCC, 2007b).

Methane

CH_4, the main component of natural gas, is the second largest contributor to anthropogenic GHG emissions and has a GWP of 21 (IPCC, 1996).

Anthropogenic emissions of CH_4 are the result of growing rice, raising cattle, combusting natural gas, and mining coal (NOAA, 2008). Atmospheric CH_4 has increased from a preindustrial concentration of 715 to 1,775 ppb in 2005 (IPCC, 2001). Although it is unclear why, atmospheric concentrations of CH_4 have not risen as quickly as anticipated (NOAA, 2008).

Nitrous Oxide

N_2O is a powerful GHG, with a GWP of 310 (IPCC, 1996). Anthropogenic sources of N_2O include agricultural processes, nylon production, fuel-fired power plants, nitric acid production, and vehicle emissions. N_2O also is used in rocket engines, racecars, and as an aerosol spray propellant. Agricultural processes that result in anthropogenic N_2O emissions are fertilizer use and microbial processes in soil and water.

N_2O concentrations in the atmosphere have increased from preindustrial levels of 270 to 319 ppb in 2005, an 18 percent increase (IPCC, 2001).

Hydrofluorocarbons

HFCs are human-made chemicals used in commercial, industrial, and consumer products and have high GWPs (EPA, 2006). HFCs generally are used as substitutes for ODSs in automobile air conditioners and refrigerants. As seen in Table 3.7-1, the most abundant HFCs, in order from most abundant to least, are HFC-134a (35 ppT), HFC-23 (17.5 ppT), and HFC-152a (3.9 ppT).

Concentrations of HFCs have risen from zero to current levels (Table 3.7-2). Because these chemicals are human-made, they do not exist naturally in ambient conditions.

Perfluorocarbons

The most abundant PFCs are CF_4 (PFC-14) and C_2F_6 (PFC-116). These human-made chemicals are emitted largely from aluminum production and semiconductor manufacturing processes. PFCs are extremely stable compounds that are destroyed only by very high-energy ultraviolet rays, which results in the very long lifetimes of these chemicals (EPA, 2006).

PFCs have large GWPs and have risen from zero to current levels (Table 3.7-2).

Sulfur Hexafluoride

Sulfur hexafluoride, another human-made chemical, is used as an electrical insulating fluid for power distribution equipment, in the magnesium industry, and in semiconductor manufacturing and also as a trace chemical for study of oceanic and atmospheric processes (EPA, 2006). In 1998, atmospheric concentrations of SF_6 were 4.2 ppT and steadily increasing in the atmosphere.

SF_6 is the most powerful of all GHGs listed in IPCC studies, with a GWP of 23,900 (IPCC, 1996).

Global Climate Change Issue

Climate change is a global problem because GHGs are global pollutants, unlike criteria air pollutants and hazardous air pollutants, which are pollutants of regional and local concern. Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (approximately 1 day), GHGs have long atmospheric lifetimes (several years to several thousand years). GHGs persist in the atmosphere for a long enough time to be dispersed around the globe. Although the exact lifetime of any particular GHG molecule depends on multiple variables and cannot be pinpointed, more CO_2 is currently emitted into the atmosphere than is sequestered. Carbon dioxide sinks, or reservoirs, include vegetation and the ocean, which absorb CO_2 through photosynthesis and dissolution, respectively. These are two of the most common processes of CO_2 sequestration. Of the total annual human-caused CO_2 emissions, approximately 54 percent is sequestered through ocean uptake, Northern Hemisphere forest regrowth, and other terrestrial sinks within a year, whereas the remaining 46 percent of human-caused CO_2 emissions remain stored in the atmosphere (Seinfeld and Pandis, 1998).

Similarly, effects of GHGs are borne globally, as opposed to localized air quality effects of criteria air pollutants and toxic air contaminants. The quantity of GHGs that it takes to ultimately result in climate change is not precisely known; suffice it to say that the quantity is enormous, and no single project would be expected to measurably contribute to a noticeable incremental change in the global average temperature, or to global, local, or microclimate.

Emissions of GHGs have the potential to adversely affect the environment, because such emissions contribute, on a cumulative basis, to global climate change. Therefore, a cumulative discussion and analysis of project impacts on global climate change is presented in this EIS, because although it is unlikely that a single project will contribute significantly to climate change, cumulative emissions from many projects affect global GHG concentrations and the climate system.

Global climate change also has the potential to result in sea level rise (resulting in flooding of low-lying areas), to affect rainfall and snowfall (leading to changes in water supply), to affect temperatures and habitats (affecting biological resources and public health), and to result in many other adverse environmental consequences.

Although the international, national, state, and regional community is beginning to address GHGs and the potential effects of climate change, it is expected that worldwide GHG emissions will continue to rise over the next several years.

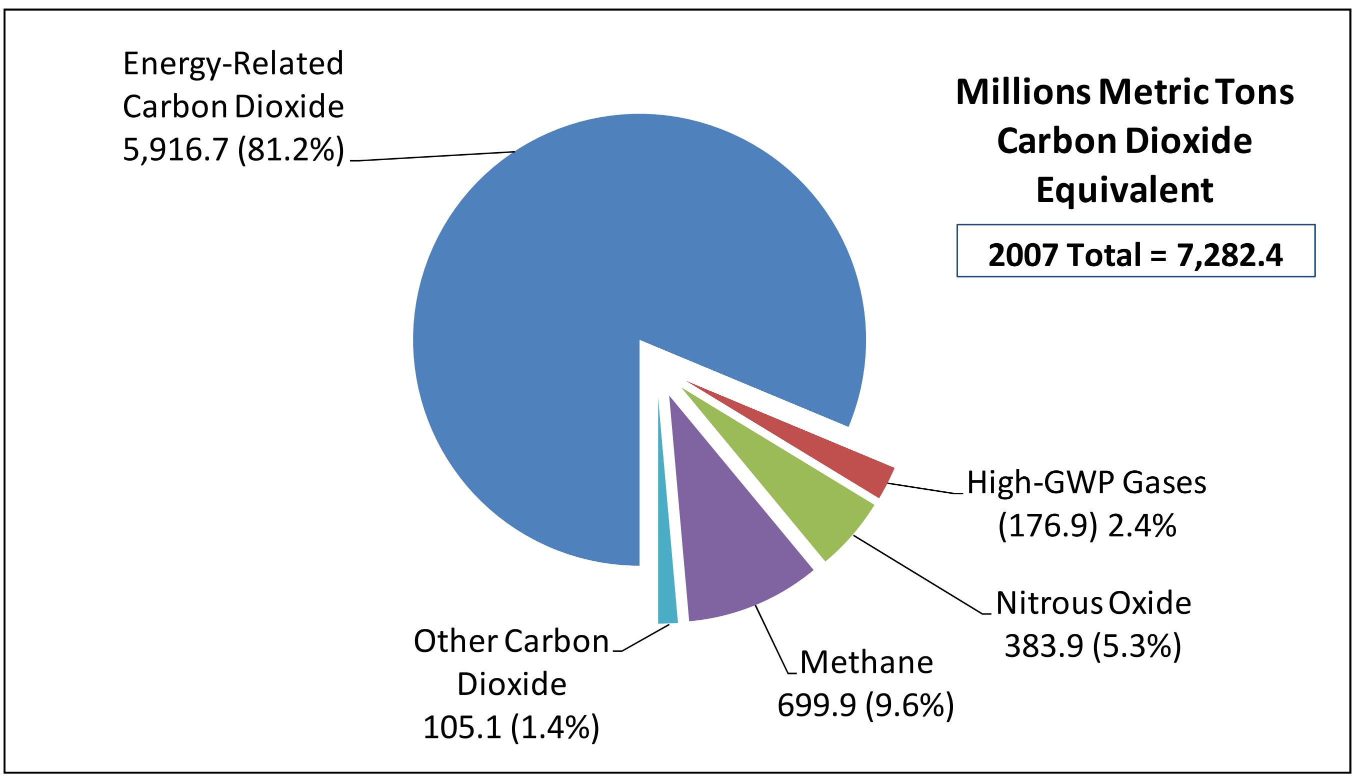
Climate and Topography

Climate is the accumulation of daily and seasonal weather events over a long period of time, whereas weather is defined as the condition of the atmosphere at any particular time and place (Ahrens, 2003). For a detailed discussion of climate and topography, see Section 3.2, "Air Quality."

Existing Greenhouse Gas Emissions

U.S. Greenhouse Gas Inventory

Total U.S. GHG emissions in 2007 were 1.4 percent above the 2006 total (USDOE, 2008). Figure 3.7-2 presents 2007 U.S. GHG emissions, including percentages, by gas.



Note: High global warming potential gases include hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.
Source: USDOE, 2008

Figure 3.7-2: 2007 U.S. Greenhouse Gas Emissions by Gas

Total emissions growth—from 7,179.7 million metric tons carbon dioxide equivalent ($MMTCO_2e$) in 2006 to 7,282.4 $MMTCO_2e$ in 2007—was largely the result of an increase in CO_2 emissions of 75.9 $MMTCO_2e$. There were larger percentage increases in emissions of other GHGs, but their absolute contributions to total emissions growth were relatively small: 13.0 $MMTCO_2e$ for CH_4, 8.2 $MMTCO_2e$ for N_2O, and 5.6 $MMTCO_2e$ for HGWPGs (USDOE, 2008).

The increase in U.S. CO_2 emissions in 2007 resulted primarily from two factors: unfavorable weather conditions, which increased demand for heating and cooling in buildings; and a drop in hydropower availability, which led to greater reliance on fossil energy sources (coal and natural gas) for electricity generation, thus increasing the carbon intensity of the power supply (USDOE, 2008). The increase in CH_4 emissions resulted from energy sources, waste management, and agriculture. The increase in N_2O is attributed primarily to an increase of emissions from nitrogen fertilization of agricultural soils.

California Greenhouse Gas Inventory

As the second largest emitter of GHG emissions in the U.S. and 12th to 16th largest in the world, California contributes a significant quantity of GHGs to the atmosphere (CEC, 2006). Emissions of CO_2 are byproducts of fossil-fuel combustion and are attributable in large part to human activities associated with transportation, industry/manufacturing, electricity and natural gas consumption, and agriculture (ARB, 2010). In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation (ARB, 2010) (Figure 3.7-3).

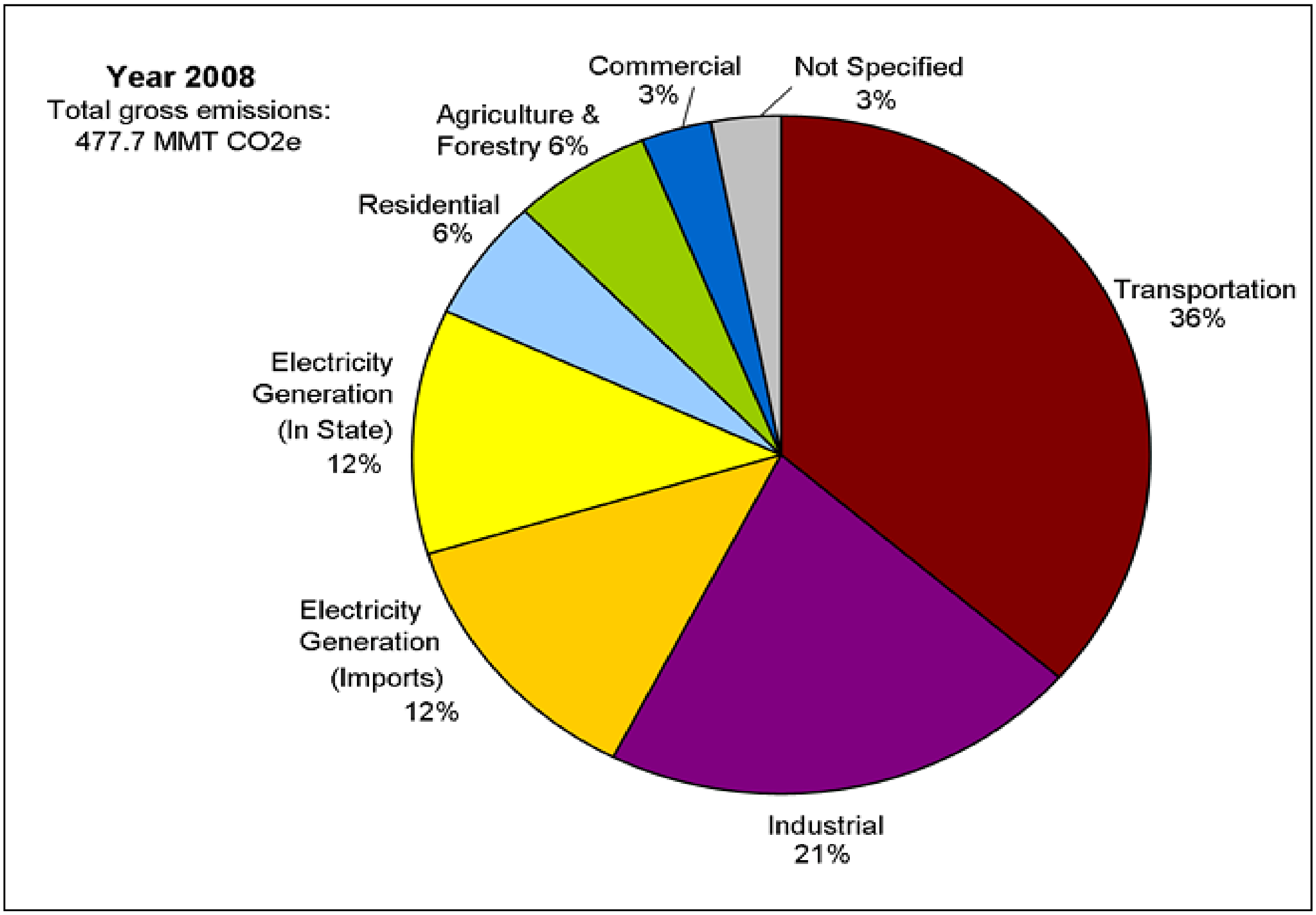
Emissions of CH_4 and N_2O are generally much lower than those of CO_2 and are associated with anaerobic microbial activity resulting from agricultural practices, flooded soils, and landfills. These two compounds, CH_4 and N_2O, have approximately 23 and 296 times the GWP of CO_2, respectively.

Bay Area Air Quality Management District Greenhouse Gas Inventory

The Bay Area Air Quality Management District (BAAQMD) published a GHG inventory for the Bay Area, which provides an estimation of GHG emissions in the base year 2007 for all seven counties located in the jurisdiction of BAAQMD: Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Napa, and the southern portions of Solano and Sonoma Counties (BAAQMD, 2010). This GHG inventory is based on the standards for criteria pollutant inventories and is intended to support BAAQMD’s climate protection activities.

The regional (Bay Area) and local (county, project location) 2007 GHG emissions from existing direct and indirect sources are shown in Table 3.7-3. The estimated GHG emissions are presented in CO_2e, which weights each GHG by its global warning potential. The GWPs used in the BAAQMD inventory are from the Second Assessment Report of the IPCC.

In 2007, San Francisco’s GHG emissions accounted for approximately 7.5 percent of the total Bay Area GHG emissions (BAAQMD, 2010). Transportation is the largest GHG emissions sector in the Bay Area and in San Francisco proper, followed by industrial/commercial, electricity generation and cogeneration, and residential fuel usage.



Source: ARB, 2010

Figure 3.7-3: 2008 California Greenhouse Gas Emissions by Sector (2000–2008 Emissions Inventory)

Table 3.7-3: 2007 Estimated Regional and Local Greenhouse Gas Emissions

Emissions Source	**Emissions in Metric Tons of CO_2e per Year (2007)**	
	Bay Area	**San Francisco**
Transportation	34,870,000 (36.41%)	2,700,000
Industrial/Commercial	34,860,000 (36.40%)	1,900,000
Electricity/Cogeneration[1]	15,200,000 (15.87%)	1,300,000
Residential Fuel Usage	6,820,000 (7.12%)	900,000
Off-Road Equipment	2,920,000 (3.05%)	400,000
Agricultural/Farming	1,110,000 (1.16%)	0
Total Emissions	**95,780,000 (100%)**	**7,200,000**

Note:
CO_2e = carbon dioxide equivalent
[1] Includes imported electricity emissions of 7,100,000 metric tons of carbon dioxide equivalent.
Source: BAAQMD, 2010

Existing SFVAMC Fort Miley Campus

In the vicinity of the existing SFVAMC Fort Miley Campus, most GHG emissions are generated by vehicle use and residential uses. At the Campus, GHG emissions are generated by operation of hospital and research buildings and by employee and patient vehicles accessing the Campus.

Specifically, stationary-source emissions related to activities at the existing SFVAMC Fort Miley Campus currently total 23,615 MT of CO_2e per year. However, with implementation of the *Department of Veterans Affairs Strategic Sustainability Performance Plan* (VA SSPP) and its related sustainability measures, stationary-source emissions at the Campus currently total 19,137 MT of CO_2e per year (Table 3.7-4).

Table 3.7-4: Existing SFVAMC Greenhouse Gas Emissions (Metric Tons of CO_2e per Year)

	Transportation	Area	Electricity	Natural Gas	Water and Wastewater	Solid Waste	TOTAL
Baseline (2012) without VA SSPP Applied	5,547.50	0.23	8,074.87	7,055.91	128.92	8,355.51	29,162.94
Baseline (2012) with VA SSPP Applied	5,547.50	0.23	5,684.74	4,967.36	128.92	8,355.51	24,684.26

CO_2e = carbon dioxide equivalent; VA SSPP = Department of Veterans Affairs Strategic Sustainability Performance Plan
Source: Data compiled by AECOM in 2012 (see Appendix B)

Mobile-source emissions related to activities at the existing SFVAMC Fort Miley Campus currently total 5,547 MT of CO_2e per year.

Thus, total GHG emissions related to activities at the Campus currently total 29,163 MT of CO_2e per year. However, with implementation of the VA SSPP and its related sustainability measures, total GHG emissions at the Campus total 24,684 MT of CO_2e per year.

Mission Bay Area

In the Mission Bay area, GHG emissions are generated by vehicle use, industrial uses, commercial uses, and residential uses. However, because there are no existing SFVAMC uses in the Mission Bay area,[6] no stationary-source or mobile-source emissions are generated by SFVAMC activities in this area.

Sea Level Rise

With respect to the SFVAMC, the most critical climate change problem is the potential for significant increase in mean sea level (msl). Such a rise may result from a combination of (a) the volumetric expansion of existing seawater as water temperatures rise significantly and (b) the increase in total (liquid) sea water as large ice deposits on land (e.g., in Antarctica, in Greenland, and worldwide in large glaciers) melt into the sea. Local sea level rise may be affected by both global sea level rise and geotectonic land mass movements and subsidence. Sea level rise refers to an increase in msl with respect to a land benchmark. Global sea level rise can be a result of

[6] The VA Downtown Clinic is located at the corner of Third Street and Harrison Streets. It is not considered part of the SFVAMC.

global warming through the expansion of seawater as the oceans warm and ice melts over land. Local sea level rise is affected by global sea level rise plus tectonic land movements and subsidence, which can be of the same order as global sea level rise.

Atmospheric pressure, ocean currents, and local ocean temperatures also affect local rates of sea level rise. The sea level has risen approximately 4,800 inches (400 feet) since the peak of the last Ice Age approximately 18,000 years ago, but the bulk of that occurred before 6,000 years ago (Axelrod, 1981). From 3,000 years ago to the start of the 19th century, the rate of sea level rise was held almost constant; however, rates of sea level rise appeared to increase worldwide in the 20th century (e.g., 8.4 inches per century or 4.2 inches every 50 years near San Francisco). In the last century, the measured rate of sea level rise near San Francisco is 8.4 inches per century or 4.2 inches every 50 years.

Most climate scientists agree that anthropogenically induced global warming will cause the rate of sea level rise to increase from current conditions further. In 2001, the IPCC released a report with projections of global sea level rise over the next century. More recent studies project different rates of sea level rise for specific regions of the globe. These regional projections are considered more reliable on a region-by-region basis than the IPCC projections. To provide a comprehensive discussion of sea level rise, both IPCC and regional projections are presented below.

IPCC projections of sea level rise vary depending on several different GHG emissions scenarios analyzed in the IPCC Special Report on Emissions Scenarios. As such, the IPCC estimates sea level rise to be between 3.6 and 34.8 inches between years 1990 and 2100 (IPCC, 2001). The IPCC model range of estimates for global sea level average rise by 2060 is predicted to be between 2.4 and 15.6 inches. However, the models used by the IPCC do not predict uniform global sea level rise, and there are substantial regional variations. The IPCC model predictions for the eastern Pacific indicate a range of sea level rise of 3.6 to 19.2 inches by 2100, which is on the lower end of the global range noted above. Most of the sea level rise predictions on the top end of the global range are for the top and bottom of the world (i.e., the polar latitudes), not the middle latitudes. Assuming net rise between 1990 and 2060 to be half of the net rise between 1990 and 2100, the geographic prediction for 2060 from the IPCC models for the eastern Pacific would be 1.8 to 9.6 inches.

While IPCC assessments of climate change and associated sea level rise rely on global models, adapting to climate change and associated sea level rise requires an understanding of how climate change will affect specific regions so that planning can take place at the state and regional levels. The California Climate Action Team relies on the IPCC Special Report on Emissions Scenarios to assess primary impacts of climate change, namely changes in the frequency and intensity of precipitation and temperature increases, on a regional level (Cayan et al., 2006, 2008). IPCC-projected temperature increases range from 2.5°F for the lowest emissions scenario to 10.4°F for the highest emissions scenario. However, the California Climate Action Team uses Rahmstorf's methodology for projecting sea level rise.

In 2007, German scientist, Stefan Rahmstorf, developed an empirical approach for projecting future sea level rise that entails calculating the relationship between sea level rise and global mean surface temperature. Rahmstorf first determined the historical trend in this relationship and then projected that trend into the future using IPCC's projected temperature increases associated with the Special Report on Emissions Scenarios, which range from

2.5°F for the lowest emissions scenario to 10.4°F for the highest emissions scenario (Rahmstorf, 2007). Rahmstorf's corresponding estimates of sea level rise by 2100 range from 10 inches to 55 inches.

IPCC's and Rahmstorf's sea level rise estimates did not include the effects of dams on sea level rise (Cayan et al., 2008). Dams constructed primarily during the 1950s to 1970s may have stored enough water worldwide to mask acceleration in the rate of sea level rise before the notable acceleration detected in 1993. As building of dams for additional upland water storage has slowed, sea level rise may now be accelerating faster than the IPCC and scientists such as Rahmstorf have predicted (Chao et al., 2008).

The Delta Vision Blue Ribbon Task Force established by Governor Arnold Schwarzenegger to develop a strategic management plan for the Sacramento–San Joaquin Delta employed an independent science board to review literature and provide recommendations on sea level rise. The Independent Science Board found that:

(1) current IPCC projections are conservative and underestimate recently measured sea level rise;

(2) empirical models, such as Rahmstorf's empirical method, yield significantly higher estimates of sea level rise over next few decades and are better for short- to mid-term planning; and

(3) neither the IPCC projections nor Rahmstorf's methodology accounts for accelerating contributions from ice sheet melting, which likely will contribute significantly to future sea level rise with the potential for very rapid increases of up to 39 inches by 2100.

Based on these findings, the Independent Science Board recommended adopting an estimated rise in sea level of 55 inches by 2100 and recommended adopting a sea level rise estimate for 2050 as well.

Therefore, even though the California Climate Action Team still relies on IPCC-projected temperature increases and Rahmstorf's methodology for projecting sea level rise, the team goes farther to account for effects of dams and accelerated ice sheet melting on sea level rise. As a result, California Climate Action Team–funded research for a 2009 report (the 2009 California Climate Adaptation Strategy) to Governor Schwarzenegger estimates that sea level rise will increase in California between 12 and 17 inches by 2050 and between 20 and 55 inches by 2099 (BCDC, 2009). In addition, the California Department of Water Resources supports a range in sea level rise of 7–55 inches along California's coast by 2100 (DWR, 2008). In addition, the most recent climate science report, the 2009 Copenhagen Diagnosis, estimates that global sea level rise will increase up to approximately 78.7 inches by 2100 (Allison et al., 2009).

Existing SFVAMC Fort Miley Campus

The existing SFVAMC Fort Miley Campus sits at an elevation of 300–350 feet relative to msl.

Mission Bay Area

The Mission Bay area ranges in elevation from 95 to 111 feet relative to msl.

3.7.2 Regulatory Framework

In November 2007 and August 2008, the Ninth Circuit U.S. Court of Appeals ruled that a NEPA document must contain a detailed GHG analysis. (*Center for Biological Diversity v. National Highway Safety Administration*, 508 F. 3d 508 (2007), was vacated and replaced by *Center for Biological Diversity v. National Highway Safety Administration*, 2008 DJDAR 12954 [August 18, 2008]).

Massachusetts et al. v. Environmental Protection Agency (2007)

Twelve U.S. states and cities, including California, in conjunction with several environmental organizations, sued in *Massachusetts et al. v. Environmental Protection Agency* to force the U.S. Environmental Protection Agency (EPA) to regulate GHGs as a pollutant pursuant to the Clean Air Act (CAA). On April 2, 2007, the U.S. Supreme Court held that EPA has the authority to regulate GHG emissions as a pollutant pursuant to the CAA. However, the court did not decide whether EPA is required to regulate GHG emissions at this time, or may exercise discretion to not regulate at this time.

Despite the Supreme Court ruling and the EPA proposal, there are no promulgated federal regulations to date limiting GHG emissions that are applicable to the SFVAMC LRDP.

U.S. Environmental Protection Agency Finding of Endangerment (2007)

On April 17, 2009, EPA issued a Proposed Endangerment and Cause or Contribute Finding for GHGs under the CAA. Through this Finding of Endangerment, the EPA Administrator proposed that current and projected concentrations of CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6 threaten the public health and welfare of current and future generations. Additionally, the Administrator proposed that combined emissions of CO_2, CH_4, N_2O, and HFCs from motor vehicles contribute to the atmospheric concentrations, and thus to the threat of climate change. Although the Endangerment Finding in itself does not place requirements on industry (including the SFVAMC LRDP), it is an important step in EPA's process to develop regulation.

U.S. Environmental Protection Agency Advance Notice of Proposed Rulemaking (2008)

In June 2008, EPA issued an Advance Notice of Proposed Rulemaking inviting comments on options and questions regarding regulation of GHGs under the CAA; however, EPA has not yet proposed or adopted regulations in response to the decision in *Massachusetts et al. v. Environmental Protection Agency*. Thus, there are no promulgated federal regulations to date limiting GHG emissions that are applicable to the SFVAMC LRDP.

U.S. Environmental Protection Agency Rule: Mandatory Reporting of GHGs (2009)

On September 22, 2009, the EPA Administrator signed a rule requiring mandatory reporting of emissions of GHGs from large sources within the United States. The rule was published in the *Federal Register* on October 30, 2009 and went into effect December 29, 2010. The rule includes emissions of CO_2, methane, nitrous oxide, HFCs, PFCs, sulfur hexafluoride, nitrogen trifluoride, hydrofluorinated ethers, and select other fluorinated compounds. Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 MT or more per year of GHG emissions are required to report annual emissions to EPA. The first annual reports for the largest emitting facilities, covering calendar year 2010, were submitted to EPA in 2011.

For purposes of this EIS, facilities proposed under Alternative 1 would not be considered a large GHG emissions source. However, facilities operating under Alternative 2 would be considered a large source. Thus, if VA were to proceed with Alternative 2, it would be required to report annual GHG emissions to EPA.

Energy Independence and Security Act

Under the 2007 Energy Independence and Security Act (EISA), the Renewable Fuel Standard program, created under the Energy Policy Act of 2005, was expanded in several key ways:

- EISA expanded the Renewable Fuel Standard program to include diesel, in addition to gasoline.
- EISA increased the volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022.
- EISA established new categories of renewable fuel, and set separate volume requirements for each one.
- EISA required EPA to apply life-cycle GHG performance threshold standards to ensure that each category of renewable fuel emits fewer GHGs than the petroleum fuel it replaces.

This expanded Renewable Fuel Standard program lays the foundation for achieving significant reductions of GHG emissions from the use of renewable fuels, for reducing use of imported petroleum, and encouraging the development and expansion of our nation's renewable fuels sector.

Implementation of the EISA Renewable Fuel Standard program would take place in the form of compliance with the VA SSPP.

California Low Carbon Fuel Standard

The purpose of the California Low Carbon Fuel Standard (Title 17, California Code of Regulations, Sections 95480–95490) is to reduce GHG emissions by reducing the full fuel-cycle, carbon intensity of the transportation fuel pool used in California. The California Low Carbon Fuel Standard generally applies to any transportation fuel that is sold, supplied, or offered for sale in California, and to any person responsible for a transportation fuel in a calendar year. The Low Carbon Fuel Standard applies to the following types of transportation fuels:

- California reformulated gasoline
- California diesel fuel
- Fossil compressed natural gas (CNG) or fossil liquefied natural gas (LNG)
- Biogas CNG or biogas LNG
- Electricity
- Compressed or liquefied hydrogen
- A fuel blend containing hydrogen
- A fuel blend containing greater than 10 percent ethanol by volume

- A fuel blend containing biomass-based diesel
- Denatured fuel ethanol (also known as E100)
- Neat biomass-based diesel (also known as B100)
- Any other liquid or nonliquid fuel

The mobile-source GHG emissions associated with the SFVAMC LRDP were modeled by taking into account the Low Carbon Fuel Standard, which aims for a 10 percent life-cycle GHG emissions reduction from increased renewable fuel use in California by 2020.

U.S. Environmental Protection Agency and National Highway Traffic Safety Administration Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards Final Rule

The final combined EPA and National Highway Traffic Safety Administration (NHTSA) standards that make up the first phase of this national program apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012–2016. They require these vehicles to meet an estimated combined average emissions level of 250 grams of CO_2 per mile, equivalent to 35.5 miles per gallon if the automobile industry were to meet this CO_2 level solely through fuel economy improvements. Together, these standards will cut GHG emissions by an estimated 960 MMT and 1.8 billion barrels of oil over the lifetime of the vehicles sold under the program.

The State of California has received a waiver from EPA to have separate, stricter Corporate Average Fuel Economy standards. Thus, implementation of EPA's NHTSA GHG Emissions and Corporate Average Fuel Economy standards would take place in the form of compliance with Assembly Bill (AB) 1493, described below.

California Assembly Bill 1493 "Pavley"—Light Duty Vehicle Greenhouse Gas Emissions Standards

EPA granted California the authority to implement GHG emission reduction standards for new passenger cars, pickup trucks, and sport utility vehicles on June 30, 2009. With the granting of this waiver, it is expected that the California AB 1493 "Pavley" regulations will reduce GHG emissions from California passenger vehicles by approximately 22 percent in 2012 and 30 percent in 2016, all while improving fuel efficiency and reducing motorists' costs.

The California Air Resources Board has adopted a new approach to passenger vehicles—cars and light trucks—by combining the control of smog-causing pollutants and GHG emissions into a single coordinated package of standards. The new approach also includes efforts to support and accelerate the numbers of plug-in hybrids and zero-emission vehicles in California.

The mobile-source GHG emissions associated with the SFVAMC LRDP were modeled by taking into account the Pavley GHG emissions standards, which require model year 2009–2016 passenger cars, light-duty trucks, and medium-duty passenger vehicles to reduce their GHG emissions from an average 0.45 percent reduction in 2009 to an average 29.7 percent reduction by 2016.

Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance"

GHG management is required by Executive Order (EO) 13514. Under the terms of EO 13514, each federal agency must do all of the following:

- Within 90 days, establish and report to the CEQ Chair and Office of Management and Budget (OMB) Director a fiscal year (FY) 2020 percentage reduction target of agencywide scope 1 and scope 2 GHG emissions in absolute terms relative to a FY 2008 baseline.
- In establishing the target, consider reductions associated with:
  - Reducing agency building energy intensity
  - Increasing agency renewable energy use and on-site projects
  - Reducing agency use of fossil fuels by:
    - Using low-GHG-emitting and alternative-fuel vehicles
    - Optimizing vehicle numbers across agency fleets
    - Reducing petroleum consumption in agency fleets of 20 or more 2 percent annually through FY 2020 relative to a FY 2005 baseline

    Where appropriate, this target excludes direct emissions from excluded vehicles and equipment as well as electric power produced and sold commercially to other parties in the course of regular business.
  - Within 240 days, establish and report to the CEQ Chair and OMB Director an FY 2020 percentage reduction target for agencywide scope 3 GHG emissions in absolute terms relative to an FY 2008 baseline.
  - In establishing the target, consider reductions associated with:
    - Pursuing opportunities with vendors and contractors to address and incentivize GHG emission reductions.
    - Implementing strategies and accommodations for transit, travel, training, and conferences that actively reduce carbon emissions associated with commuting and travel by agency staff.
    - Meeting GHG emissions reductions associated with other federal government sustainability goals.
    - Implementing innovative policies and practices that address agency specific scope 3 GHG emissions.
  - Within 15 months, establish and report to the CEQ Chair and OMB Director a comprehensive inventory of absolute GHG emissions across all three scopes for FY 2010. Comprehensive inventories must be submitted annually thereafter at the end of each January.

VA has completed the aforementioned EO 13514 requirements in the form of the VA SSPP. This VA SSPP Plan would be adhered to with implementation of the SFVAMC LRDP.

Department of Veterans Affairs Strategic Sustainability Performance Plan

The VA SSPP responds to Section 8 of EO 13514, which requires federal agencies to "develop, implement, and annually update an integrated Strategic Sustainability Performance Plan that will prioritize agency actions" for meeting sustainability goals identified in statutes, regulations, and executive orders. The VA SSPP identifies

VA's sustainability goals and defines VA's policy and strategy for achieving these goals. It provides a means to review and evaluate VA's performance and progress toward achieving the sustainability goals (VA, 2010).

VA is targeting a 29.6 percent reduction in Scope 1 (direct) and Scope 2 (indirect) GHG emissions by FY 2020 below the FY 2008 baseline. A 26.2 percent reduction in emissions is projected to come from meeting the FY 2015 alternative fuel use, petroleum reduction, energy intensity reduction, and on-site renewable electricity targets as set forth in the Energy Policy Act of 2005. VA plans to meet these targets through a combination of initiatives funded at the facility, regional, and department levels. Facility- and regional-level strategies include energy conservation measures, retro-commissioning, installation of alternative fueling stations, and on-site renewable electricity generation. Projects funded at the department level include additional alternative fueling stations as well as additional on-site renewable electricity generation through technologies such as solar and renewably fueled combined heat and power (CHP).

VA's current plan to achieve further reductions after FY 2015 is to leverage renewably fueled CHP. Based on a preliminary inventory, 99 percent of VA Scope 1 and Scope 2 emissions come from Veterans Health Administration (VHA) operations and 90 percent of those emissions are from purchased electricity and on-site energy generation. In addition, the large thermal loads at VA medical centers make them good candidates for CHP. VA has identified renewably fueled CHP projects at VA medical centers that would produce an estimated 170,000 megawatt-hours per year. These projects are projected to provide the additional 3.4 percent reduction required to meet VA's FY 2020 GHG goal.

VA has set an FY 2020 Scope 3 GHG emissions reduction target of 10 percent below the FY 2008 baseline. VA considers this target to be aggressive but achievable, despite its limited ability to control the sources of Scope 3 emissions. VA's emissions from employee commuting are a particular challenge, given the current size of VA and its potential for growth to meet the demand for Veterans care and services. To meet its target, VA is relying on a combination of strategies and technology advances that include meeting existing targets (such as energy intensity and pollution prevention); improving fuel economy based on Corporate Average Fuel Economy standards; implementing innovative commuting strategies; and developing an action plan that will address noncommuting emissions, such as telework and alternate work schedules.

This VA SSPP would be adhered to with implementation of the SFVAMC LRDP. Specifically, SFVAMC LRDP direct and indirect (Scope 1 and 2) GHG emissions related to electricity and natural gas take into account the 29.6 percent reduction through compliance with the SSPP. SFVAMC LRDP mobile-source (Scope 3) GHG emissions related to individual vehicle commutes did not take into account the 10 percent reduction target, because the SFVMAC does not have direct control over such sources of emissions.

3.7.3 Environmental Consequences

Significance Criteria

A NEPA evaluation must consider the context and intensity of the environmental effects that would be caused by, or result from, the EIS Alternatives.

CEQ's national guidance suggests that federal agencies consider opportunities to reduce GHG emissions caused by proposed federal actions and adapt their actions to climate change impacts throughout the NEPA process and address these issues in their agency NEPA procedures. According to CEQ's draft national guidance, there are two main considerations when addressing climate change in environmental documentation: (1) the GHG emissions effects of a proposed action and alternative actions and (2) the impacts of climate change on a proposed action or alternatives. Therefore, this analysis discloses both the proposed LRDP's contribution to climate change and the effects that climate change may have on implementation of the LRDP Alternatives.

CEQ national guidance refers to a quantitative GHG emissions significance threshold of 25,000 $MTCO_2e$ per year for inclusion of a GHG analysis within a NEPA document. Therefore, absent established quantitative thresholds, an alternative would be considered to result in an adverse impact related to GHG emissions if it would:

- make a considerable contribution to cumulative GHG emissions and global climate change. Annual GHG emissions totaling more than 25,000 $MTCO_2e$ per year would be considered a cumulatively considerable contribution to GHG emissions for the purposes of this EIS.

No quantitative climate change significance thresholds have been set for the effect of climate change on the region/project. However, absent guidance and established quantitative thresholds, an alternative is considered to result in an adverse impact if it would:

- result in development or ongoing operations in a region that is unprepared for inevitable environmental changes that would occur from climate change and, thus, harm persons/property or degrade natural resources/ecosystems.

Assessment Methods

Greenhouse Gas Emissions

- The magnitude of project emissions was quantified. Therefore, numerical GHG emissions of the proposed LRDP are included as part of the impact discussion.
- URBEMIS was used to estimate GHG emissions associated with construction of individual development projects, and the BAAQMD Greenhouse Gas Model (BGM) model was used to estimate operational GHG emissions. URBEMIS is designed to model construction emissions for land use development projects based on building size, land use and type, and disturbed acreage and allows for the input of project-specific information. BGM was developed for use with URBEMIS, and calculates operational GHG emissions associated with a project at buildout, including those emissions resulting from transportation (trip generation), electricity use, natural gas use, solid waste generation, water and wastewater use, and other area sources (hearth and landscaping).
- Construction-generated GHG emissions were modeled based on general information provided in Chapter 2.0, "Alternatives," and default BAAQMD-recommended settings and parameters attributable to the proposed land use type and site location. The URBEMIS model only provides estimates of emissions of CO_2. Although emissions of other GHGs, such as CH_4 and N_2O, are important with respect to global climate change, the emission levels of these other GHGs from on- and off-road vehicles used during construction are about two to three orders of magnitude smaller than CO_2 emissions, even when factoring in the relatively larger global warming potentials of CH_4 and N_2O (CCAR, 2009).

- GHG emissions associated with the operation of the proposed LRDP were modeled using BGM Version 1.1.9 beta, with default San Francisco Bay Area values for temperature, humidity, and vehicle fleet characteristics as well as energy consumption, waste generation, water use, and wastewater generation rates for various land uses. All modeling assumptions and output summaries are contained in Appendix B.

Global Climate Change

- The impacts of global climate change on the alternatives are described at a qualitative level, because local/regional projections of specific climate change effects (such as regionally downscaled versions of global climate models) have not yet been developed. Scientific findings are summarized and discussed in broad implications for the LRDP. Thus, this section includes an overview of the potential impacts of the EIS Alternatives in the context of global climate change related to sea level rise, and the potential impact associated with the effect of an alternative in the context of global climate change is determined in a qualitative manner.

Alternative 1: SFVAMC Fort Miley Campus Buildout Alternative

Near-Term Projects

Construction

Greenhouse Gas Emissions

Under Alternative 1, Phase 1 (near-term projects), construction emissions at the existing SFVAMC Fort Miley Campus would total 904 MT of CO_2e. There are no VA sustainability measures relevant to construction-related GHG emissions; thus, no sustainability measures were applied to determine total construction-related GHG emissions. However, these construction-related GHG emissions would be emitted only once and would be spread out over approximately a 2.5-year time period (from early 2013 to mid 2015). Thus, construction of Alternative 1 near-term projects would not make a considerable contribution to cumulative GHG emissions and global climate change. This impact would be minor.

Operation

Greenhouse Gas Emissions

Table 3.7-5 presents the GHG emissions related to operation of Alternative 1, Phase 1 (near-term) projects at the existing SFVAMC Fort Miley Campus. Operational GHG emissions during Alternative 1, Phase 1 would total 4,264 MT of CO_2e per year. Of this total, mobile-source emissions would total 243 MT of CO_2e per year, and stationary-source emissions would total 4,021 MT of CO_2e per year (Table 3.7-5). However, with implementation of the VA SSPP and its related sustainability measures, stationary-source emissions at the Campus would be reduced to 3,634 MT of CO_2e per year under Alternative 1, Phase 1 (Table 3.7-5).

Table 3.7-5: Alternative 1, Phase 1 (Near-Term) Operational Greenhouse Gas Emissions (Metric Tons of CO_2e per Year)

	Transportation	Area	Electricity	Natural Gas	Water and Wastewater	Solid Waste	TOTAL
Phase 1 (mid-2015) without VA SSPP Applied	243.23	0.23	1,374.75	1,201.27	21.89	1,422.46	4,263.82
Phase 1 (mid-2015) with VA SSPP Applied	243.23	0.23	1,168.54	1,021.08	21.89	1,422.46	3,877.43

Note: VA SSPP = Department of Veterans Affairs Strategic Sustainability Performance Plan
Source: Data compiled by AECOM in 2012 (see Appendix B)

Therefore, with implementation of the VA SSPP and its related sustainability measures, total GHG emissions at the existing SFVAMC Fort Miley Campus under Alternative 1, Phase 1 would total 3,877 MT of CO_2e per year. Because operations of Alternative 1 near-term projects would result in GHG emissions well below 25,000 $MTCO_2$e per year, implementing Alternative 1 near-term projects would not make a considerable contribution to cumulative GHG emissions and global climate change. This impact would be minor.

Impact of Climate Change on Alternative 1, Phase 1

Based on sea level rise predictions of 12–17 inches by 2050 and 20 to 55 inches by 2099 (BCDC, 2009), sea level rise could cause flooding in some of the coastal areas of San Francisco. However, because the existing SFVAMC Fort Miley Campus is situated at a much higher elevation (292–320 feet above msl) than the Pacific Ocean (0 feet above msl), no climate change–related sea level rise impacts would occur at the Campus under Alternative 1, Phase 1 by mid-2015. Therefore, Phase 1 (near-term) development under Alternative 1 would not be unprepared for inevitable environmental changes that would occur from climate change, and thus, those changes would not result in harm to persons or property or degradation natural resources or ecosystems. No impact would occur.

Long-Term Projects

Construction

Greenhouse Gas Emissions

Under Alternative 1, Phase 2 (long-term projects), construction emissions at the existing SFVAMC Fort Miley Campus would total 1,000 MT of CO_2e. There are no VA sustainability measures relevant to construction-related GHG emissions; thus, no sustainability measures were applied to determine total construction-related GHG emissions. However, these construction-related GHGs would be emitted only once and would be spread out over a time period of approximately 8 years (from mid-2015 to early 2023). Thus, construction of Alternative 1 long-term projects would not make a considerable contribution to cumulative GHG emissions and global climate change. This impact would be minor.

Operation

Greenhouse Gas Emissions

Table 3.7-6 presents the GHG emissions related to operation of Alternative 1, Phase 2 (long-term) projects at the existing SFVAMC Fort Miley Campus. Operational GHG emissions during Alternative 1, Phase 2 would total 5,742 MT of CO_2e per year. Of this total, mobile-source emissions would total 2,010 MT of CO_2e per year, and stationary-source emissions would total 3,733 MT of CO_2e per year (Table 3.7-6). However, with implementation of the VA SSPP and its related sustainability measures, stationary-source emissions at the Campus would total 3,025 MT of CO_2e per year under Alternative 1, Phase 2 (Table 3.7-6).

Table 3.7-6: Alternative 1, Phase 2 (Long-Term) Operational Greenhouse Gas Emissions (Metric Tons of CO_2e per Year)

	Transportation	Area	Electricity	Natural Gas	Water and Wastewater	Solid Waste	TOTAL
Phase 2 (early 2023) without VA SSPP Applied	2,009.52	0.23	1,276.50	1,115.42	20.25	1,320.35	5,742.27
Phase 2 (early 2023) with VA SSPP Applied	2,009.52	0.23	898.66	785.26	20.25	1,320.35	5,034.27

Note: VA SSPP = Department of Veterans Affairs Strategic Sustainability Performance Plan
Source: Data compiled by AECOM in 2012 (see Appendix B)

Therefore, with implementation of the VA SSPP and its related sustainability measures, total GHG emissions at the existing SFVAMC Fort Miley Campus under Alternative 1, Phase 2 would total 5,034 MT of CO_2e per year, resulting in a total net increase in GHG emissions under Alternative 1, Phases 1 and 2 (near-term and long-term projects) of 8,911 MT of CO_2e. Because operations of Alternative 1 long-term projects would result in GHG emissions well below 25,000 MTCO_2e per year, implementing Alternative 1 long-term projects would not make a considerable contribution to cumulative GHG emissions and global climate change. This impact would be minor.

Impact of Climate Change on Long-Term Projects under Alternative 1, Phase 2

Based on sea level rise predictions of 12–17 inches by 2050 and 20–55 inches by 2099 (BCDC, 2009), sea level rise could cause flooding in some of the coastal areas of San Francisco. However, because the existing SFVAMC Fort Miley Campus is situated at a much higher elevation (292–320 feet above msl) than the Pacific Ocean (0 feet above msl), no climate change–related sea level rise impacts would occur at the Campus under Alternative 1, Phase 2 by 2023. Therefore, Phase 2 (long-term) development under the LRDP would not be unprepared for inevitable environmental changes that would occur from climate change, and thus, those changes would not result in harm to persons or property or degradation natural resources or ecosystems. No impact would occur.

Alternative 2: SFVAMC Fort Miley Campus plus Mission Bay Campus Alternative

Near-Term Projects

Alternative 2 near-term projects (both construction and operation) would be the same as Alternative 1 near-term projects (see Tables 2-1 and 2-2 and Figures 2-1 and 2-2). Therefore, the impacts of Alternative 2 near-term projects impacts would be the same as the impacts of Alternative 1 near-term projects. These impacts would range in significance from no impact to minor.

Long-Term Projects

Alternative 2 long-term projects (both construction and operation) located at the SFVAMC Fort Miley Campus would be the same as Alternative 1 long-term projects, except that the ambulatory care center would be located at the potential new SFVAMC Mission Bay Campus under Alternative 2 (see Tables 2-1 and 2-2 and Figures 2-1 and 2-2). Therefore, the impacts of Alternative 2 long-term projects at the SFVAMC Fort Miley Campus would be the same as or less than the impacts of Alternative 1 long-term projects. The impact discussion below focuses primarily on the impacts at the potential new SFVAMC Mission Bay Campus from construction and operation of the ambulatory care center, research building, and associated parking structures proposed as part of Alternative 2, Phase 2.

Construction

Greenhouse Gas Emissions

Under Alternative 2, Phase 2 (long-term projects), construction emissions at the existing SFVAMC Fort Miley Campus would total 667 MT of CO_2e, and construction emissions at the potential new SFVAMC Mission Bay Campus would total 1,190 MT of CO_2e. It should be noted that due to the construction of the ambulatory care center at the potential new SFVAMC Mission Bay Campus versus at the existing SFVAMC Fort Miley Campus under Alternative 2, projected emissions at the existing SFVAMC Fort Miley Campus would be less than under Alternative 1. There are no VA sustainability measures relevant to construction-related GHG emissions; thus, no sustainability measures were applied to determine total construction-related GHG emissions. However, these construction-related GHG emissions would be emitted only once and would be spread out over a time period of approximately 12 years (from late 2015 to late 2027). Thus, construction of Alternative 2 long-term projects would not make a considerable contribution to cumulative GHG emissions and global climate change. This impact would be minor.

Operation

Greenhouse Gas Emissions

Table 3.7-7 presents the GHG emissions related to operation of Alternative 2, Phase 2 (long-term) projects at the existing SFVAMC Fort Miley Campus and the potential new SFVAMC Mission Bay Campus. Operational GHG emissions during Alternative 2, Phase 2 would total 1,921 MT of CO_2e per year for the existing Campus and 14,962 MT of CO_2e per year for the proposed new Campus. Of these totals, mobile-source emissions would total 549 MT of CO_2e per year for the existing Campus and 2,762 MT of CO_2e per year for the potential new Campus

(Table 3.7-7). Stationary-source emissions would total 1,372 MT of CO_2e per year at the existing Campus and 12,199 MT of CO_2e per year at the potential new Campus (Table 3.7-7). However, with implementation of the VA SSPP and its related sustainability measures, stationary-source emissions would total 1,112 MT of CO_2e per year at the existing Campus and 9,885 MT of CO_2e per year at the potential new Campus under Alternative 2, Phase 2 (Table 3.7-7). It should be noted that the difference in emissions at the existing SFVAMC Fort Miley Campus between Alternatives 1 and 2 is due to the difference in overall square footage that would occur under Alternative 2 versus Alternative 1.

Table 3.7-7: Alternative 2, Phase 2 (Long-Term) Operational Greenhouse Gas Emissions (Metric Tons of CO_2e per year)

	Transportation	Area	Electricity	Natural Gas	Water and Wastewater	Solid Waste	TOTAL
Phase 2 (2027) without VA SSPP Applied at the SFVAMC Fort Miley Campus	549.30	0.23	469.02	409.83	7.44	485.12	1,920.94
Phase 2 (2027) with VA SSPP Applied at the SFVAMC Fort Miley Campus	549.30	0.23	330.19	288.52	7.44	485.12	1,660.80
Phase 2 (2027) without VA SSPP Applied at the SFVAMC Mission Bay Campus	2,762.34	0.23	4,172.02	3,645.55	66.17	4,315.31	14,961.63
Phase 2 (2027) with VA SSPP Applied at the SFVAMC Mission Bay Campus	2,762.34	0.23	2,937.10	2,566.47	66.17	4,315.31	12,647.62
Total Phase 2 without VA SSPP Applied	3,311.64	0.46	4,641.04	4,055.38	73.61	4,800.43	16,882.57
Total Phase 2 with VA SSPP Applied	3,311.64	0.46	3,267.29	2,854.99	73.61	4,800.43	14,308.42

Notes: CO_2e = carbon dioxide equivalent; SFVAMC = San Francisco Veterans Affairs Medical Center; VA SSPP = *Department of Veterans Affairs Strategic Sustainability Performance Plan*
Source: Data compiled by AECOM in 2012 (see Appendix B)

Therefore, with implementation of the VA SSPP and its related sustainability measures under Alternative 2, Phase 2, GHG emissions would total 1,661 MT of CO_2e per year at the existing SFVAMC Fort Miley Campus and 12,648 MT of CO_2e per year at the potential new SFVAMC Mission Bay Campus. Combined, Phase 2 would result in generation of 16,883 MT of CO_2e per year without implementation of the VA SSPP and 14,308 MT of CO_2e with implementation of the VA SSPP. Taken into consideration with the projected emissions of Alternative 2 near-term projects, implementation of Alternative 2 would result in generation of 21,146 MT of CO_2e per year without implementation of the VA SSPP and 18,186 MT of CO_2e with implementation of the VA SSPP. Because operations of Alternative 2 long-term projects at the potential new SFVAMC Mission Bay Campus would result in GHG emissions below 25,000 $MTCO_2$e per year, operation of Alternative 2 long-term projects would not make a considerable contribution to cumulative GHG emissions and global climate change. This impact would be minor.

Impact of Climate Change on Long-Term Projects under Alternative 2, Phase 2

Based on sea level rise predictions discussed above in Section 3.7.1, "Affected Environment," sea level rise could cause flooding in the urbanized areas of San Francisco. Because a specific location for the potential new SFVAMC Mission Bay Campus has not been identified and the elevation of the site of the potential new Campus relative the San Francisco Bay is unknown, significant and adverse climate change–related sea level rise impacts could occur at the potential new Campus by the year 2035. However, a project-level environmental review would be conducted in the future when more specific project details are available. It is anticipated that project design elements would be incorporated in order to address this issue as required by federal, State, and local codes and regulations. Therefore, this impact would be minor.

Alternative 3: No Action Alternative

Near-Term Projects

Construction

Greenhouse Gas Emissions

No near-term, construction-related GHG emissions impacts would occur under Alternative 3.

Operation

Greenhouse Gas Emissions

Under Alternative 3, there would be no LRDP-related operational GHG emissions above current conditions. Baseline 2015 (i.e., future without project) conditions for GHG emissions are shown in Table 3.7-8. It should be noted that the decrease in total mobile-source GHG emissions shown with implementation of Alternative 3 are attributed to efficiencies in vehicle emissions rates that would occur between early 2013 and mid-2015. Furthermore, the decrease in energy-related emissions can be attributed to the implementation of the VA SSPP and not part of Alternative 3. Therefore, no impact would occur.

Table 3.7-8: Mid-2015 Future without Project Greenhouse Gas Emissions (Metric Tons of CO_2e per year)

	Transportation	Area	Electricity	Natural Gas	Water and Wastewater	Solid Waste	TOTAL
Baseline (mid-2015) without VA SSPP Applied	5,195.17	0.23	8,074.87	7,055.91	128.08	8,355.11	28,809.89
Baseline (mid-2015) with VA SSPP Applied	5,195.17	0.23	5,684.71	4,967.36	128.08	8,355.11	24,330.66

Note: CO_2e = carbon dioxide equivalent; VA SSPP = Department of Veterans Affairs Strategic Sustainability Performance Plan
Source: Data compiled by AECOM in 2012 (see Appendix B)

<u>Impact of Climate Change under Alternative 3, Phase 1</u>

Based on sea level rise predictions of 12–17 inches by 2050 and 20 to 55 inches by 2099 (BCDC, 2009), sea level rise could cause flooding in some of the coastal areas of San Francisco. However, because the existing SFVAMC Fort Miley Campus is situated at a much higher elevation (292–320 feet above msl) than the Pacific Ocean (0 feet above msl), no climate change–related sea level rise impacts are anticipated to occur at the Campus under Alternative 3, Phase 1 by mid-2015. Therefore, existing development on the SFVAMC Fort Miley Campus would not be unprepared for inevitable environmental changes that would occur from climate change, and thus, those changes would not result in harm to persons or property or degradation natural resources or ecosystems. No impact would occur.

Long-Term Projects

<u>Construction</u>

Greenhouse Gas Emissions

No long-term, construction-related GHG emissions impacts would occur under Alternative 3.

<u>Operation</u>

Greenhouse Gas Emissions

Under Alternative 3, there would be no LRDP-related operational GHG emissions above current conditions. However, baseline 2035 (i.e., future without project) conditions for GHG emissions are shown in Table 3.7-9. As with near-term conditions identified above for Alternative 3, the decrease in total mobile-source GHG emissions shown with implementation of this alternative are attributed to efficiencies in vehicle emissions rates that would occur between 2011 and 2020,[7] and the decrease in energy-related emissions can be attributed to the implementation of the VA SSPP and not part of Alternative 3. Therefore, no impact would occur.

Table 3.7-9: 2023 Future without Project Greenhouse Gas Emissions (Metric Tons of CO_2e per year)

	Transportation	Area	Electricity	Natural Gas	Water and Wastewater	Solid Waste	TOTAL
Baseline (2023) without VA SSPP Applied	4,014.82	0.23	8,074.87	7,055.91	127.02	8,352.53	27,625.38
Baseline (2023) with VA SSPP Applied	4,014.82	0.23	5,684.71	4,967.36	127.02	8,352.53	23,146.67

Notes: CO_2e = carbon dioxide equivalent; VA SSPP = Department of Veterans Affairs Strategic Sustainability Performance Plan
Source: Data compiled by AECOM in 2012 (see Appendix B)

7 This is per a new national fuel economy program, which adopts uniform federal standards to regulate both fuel economy and greenhouse gas emissions, covers model year 2012 to model year 2016, and requires an average fuel economy standard of 35.5 miles per US gallon in 2016 (specifically, 39 miles per gallon for cars and 30 mpg for trucks). This is a jump from the current average for all vehicles of 25 miles per gallon.

Impact of Climate Change under Alternative 3, Phase 2

Based on sea level rise predictions of 12–17 inches by 2050 and 20 to 55 inches by 2099 (BCDC, 2009), sea level rise could cause flooding in some of the coastal areas of San Francisco. However, because the existing SFVAMC Fort Miley Campus is situated at a much higher elevation (292–320 feet above msl) than the Pacific Ocean (0 feet above msl), no climate change–related sea level rise impacts are anticipated to occur at the Campus under Alternative 3, Phase 2 by 2023. Therefore, existing development on the SFVAMC Fort Miley Campus would not be unprepared for inevitable environmental changes that would occur from climate change, and thus, those changes would not result in harm to persons or property or degradation natural resources or ecosystems. No impact would occur.

3.7.4 References

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