4.2 Air Quality

4.2.1 Introduction

This section presents existing air quality conditions in the project area and analyzes the potential air quality impacts associated with implementation of the proposed Computational Research and Theory (CRT) project. This section also provides a description of the regulatory framework for air quality management on a federal, state, regional, and local level. In addition, this section will evaluate the types and quantities of air emissions that would be generated on a temporary basis due to project construction and over the long term due to the project's operation.

The analysis of air quality impacts is based on air quality regulations administered by the U.S. Environmental Projection Agency (U.S. EPA), the California Air Resources Board (CARB), and the Bay Area Air Quality Management District (BAAQMD) with each agency responsible for different aspects of the proposed project's activities. The roles of these agencies are discussed in detail in the Regulatory Considerations section. Other sources used in this assessment include the BAAQMD CEQA [California Environmental Quality Act] Guidelines [for] Assessing the Air Quality Impacts of Projects and Plans established by the BAAQMD in December 1999; and the Bay Area 2005 Ozone Strategy, adopted by the BAAQMD in January 2006. Other sources of information used in this section include Lawrence Berkeley National Laboratory (LBNL) documents, the general plans for the cities of Berkeley and Oakland, the Environmental Impact Report (EIR) for the Berkeley General Plan, other environmental documents associated with LBNL projects, and the University of California [UC] CEQA Handbook prepared by the UC Office of the President.

In response to the Notice of Preparation for this EIR, a commenter expressed concern regarding carbon emissions associated with tree removal (loss of carbon sequestration) from the project site and Strawberry Canyon. However, the proposed project would replace any removed trees at a 1:1 ratio (see Section 4.3 Biological Resources), which would help offset any reduction in carbon sequestration resulting from project-related tree removal. Other commenters requested that the EIR address cumulative impacts of LBNL development on human and ecological health and safety. The cumulative health impacts of future operations associated with LBNL are discussed in Section 5.0, Cumulative Impacts, of this EIR.

4.2.2 Environmental Setting

Climate and Meteorology

The project area is located in the cities of Berkeley and Oakland within the boundaries of the San Francisco Bay Area Air Basin (SFBAAB or the Basin). The climate of the Bay Area is Mediterranean in character, with mild, rainy winter weather from November through March and warm, dry weather from June through October. In summer, the Pacific high-pressure system typically remains near the coast of California; subsidence of warm air over the cooler marine air associated with the Pacific high creates frequent summer atmospheric temperature inversions. Subsidence inversions may be several hundred to several thousand feet deep, effectively trapping pollutants in a stagnant volume of air near the ground with little dispersion ability. Typically, May through October is considered the ozone smog season when transport studies have shown precursor emissions generated in Oakland and Berkeley are often transported to other regions of the Bay Area and beyond (e.g., Central Valley) that are more conducive to the formation of ozone. In winter, the Pacific high-pressure system moves southward, allowing ocean-formed storms to move through the region. The frequent storms and infrequent periods of sustained sunny weather are not conducive to ozone formation. Radiational cooling during the evening, however, sometimes creates thin inversions and concentrates air pollutant emissions near the ground.

Mean minimum temperatures in the project area range from high 50s in the summer to the low 40s in the winter. The average temperature in the area is the mid 50s with mean maximum summer temperatures in the low 80s and winter temperatures in the low 60s. Annual and daily temperatures in the region have fairly small oscillations due to the moderating effects of the nearby ocean. In contrast to the steady temperature regime, rainfall is highly variable and confined almost exclusively to the “rainy” period from November through April. The area receives approximately 30 inches of rainfall annually, of which about 95 percent occurs during November to April. Precipitation may vary widely from year to year as a shift in the annual storm track of a few hundred miles can mean the difference between a very wet year and drought conditions. Winds in the project area typically vary diurnally. The usual pattern consists of daytime, winds originating off-shore from the west and northwest as air is funneled through the Golden Gate, and nighttime, winds originating from the east and southeast due to the cooling of land areas. Summer afternoon sea breezes can often exceed 20 miles per hour. Peak annual winds occur during winter storms. South and southeast winds typically also precede weather systems passing through the region.

Regional Air Quality

The determination of whether a region’s air quality is healthful or unhealthful is made by comparing contaminant levels in ambient air samples to national and state standards. Health-based air quality standards have been established by California and the federal government for the following criteria air pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter less than 10 microns in diameter (PM_{10}), fine particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). These standards were established to protect sensitive receptors with a margin of safety from adverse health impacts due to exposure to air pollution. California has also established standards for sulfates, visibility reducing particles, hydrogen sulfide, and vinyl chloride. The state and national ambient air quality standards for each of the monitored pollutants and the current attainment status designation for the SFBAAB are summarized in Table 4.2-1, Ambient Air Quality Standards.

The National Ambient Air Quality Standards (NAAQS) (other than ozone, PM_{10}, $PM_{2.5}$ and those based on annual averages or arithmetic mean) are not to be exceeded more than once per year. The NAAQS for ozone, PM_{10}, and $PM_{2.5}$ are based on statistical calculations over 1- to 3-year periods, depending on the pollutant. The SFBAAB is currently designated as a marginal nonattainment area with respect to the national standard for ozone and is designated as attainment or unclassifiable for all other pollutants. Additional details regarding the federal attainment status of the SFBAAB are provided in Table 4.2-5 below. Air quality of a region is considered to be in attainment of the state standards if the measured ambient air pollutant levels for OZONE, CO, SO_2 (1- and 24-hour), NO_2, PM_{10}, $PM_{2.5}$, and visibility reducing particles are not exceeded, and all other standards are not equaled or exceeded at any time in any consecutive three-year period. The SFBAAB is currently designated as a nonattainment area with respect to the state standards for OZONE, PM_{10}, and $PM_{2.5}$ and is designated as attainment or unclassified for all other pollutants. Additional details regarding the state attainment status of the SFBAAB are provided in Table 4.2-6 below.

Table 4.2-1
Ambient Air Quality Standards

Air Pollutant	State Standard	Federal Primary Standard	Most Relevant Health Effects
Ozone	0.070 ppm, 8-hr. avg. 0.09 ppm, 1-hr. avg.	0.08 ppm, 8-hr avg. (3-year average of annual 4th-highest daily maximum)	(a) Short-term exposures: Pulmonary function decrements and localized lung edema in humans and animals and risk to public health implied by alterations in pulmonary morphology and host defense in animals; (b) Long-term exposures: Risk to public health implied by altered connective tissue metabolism and altered pulmonary morphology in animals after long-term exposures, and pulmonary function decrements in chronically exposed humans; (c) Vegetation damage; and (d) Property damage
Carbon Monoxide	9.0 ppm, 8-hr avg. 20 ppm, 1-hr avg.	9 ppm, 8-hr avg. 35 ppm, 1-hr avg.	(a) Aggravation of angina pectoris and other aspects of coronary heart disease; (b) Decreased exercise tolerance in persons with peripheral vascular disease and lung disease; (c) Impairment of central nervous system functions; and (d) Possible increased risk to fetuses

Air Pollutant	State Standard	Federal Primary Standard	Most Relevant Health Effects
Nitrogen Dioxide	0.25 ppm, 1-hr avg.	0.053 ppm, annual arithmetic mean	(a) Potential to aggravate chronic respiratory disease and respiratory symptoms in sensitive groups; (b) Risk to public health implied by pulmonary and extra-pulmonary biochemical and cellular changes and pulmonary structural changes; and (c) Contribution to atmospheric discoloration
Sulfur Dioxide	0.04 ppm, 24-hr avg. 0.25 ppm, 1-hr. avg.	0.030 ppm, annual arithmetic mean 0.14 ppm, 24-hr avg.	(a) Bronchoconstriction accompanied by symptoms which may include wheezing, shortness of breath and chest tightness, during exercise or physical activity in person with asthma
Respirable Particulate Matter	20 µg/m^3, annual arithmetic mean 50 µg/m^3, 24-hr avg.	150 µg/m^3, 24-hr avg.	(a) Excess deaths from short-term exposures and exacerbation of symptoms in sensitive patients with respiratory disease; and (b) Excess seasonal declines in pulmonary function, especially in children
Fine Particulate Matter	12 µg/m^3, annual arithmetic mean	15 µg/m3, annual arithmetic mean (3-year average) 35 µg/m3, 24-hr avg. (3-year average of 98th percentile)	(a) Increased hospital admissions and emergency room visits for heart and lung disease; (b) Increased respiratory symptoms and disease; and (c) Decreased lung function and premature death
Sulfates	25 µg/m^3, 24-hr avg.	None	(a) Decrease in ventilatory function; (b) Aggravation of asthmatic symptoms; (c) Aggravation of cardio-pulmonary disease; (d) Vegetation damage; (e) Degradation of visibility; and (f) Property damage
Lead[1]	1.5 µg/m^3, 30-day avg.	1.5 µg/m^3, calendar quarterly average	(a) Increased body burden; and (b) Impairment of blood formation and nerve conduction
Visibility-Reducing Particles	In sufficient amount to produce extinction of 0.23 per kilometer due to particles when relative humidity less than 70%, 8-hr average (10 AM to 6 PM)	None	Visibility impairment on days when relative humidity is less than 70 percent
Hydrogen Sulfide	0.03 ppm, 1-hr avg.	None	Odor annoyance
Vinyl Chloride[1]	0.01 ppm, 24-hr avg.	None	Known carcinogen

Sources: BAAQMD. Air Pollutants Regulated by the District. [September 19, 2007]; http://www.baaqmd.gov/dst/pollutants.htm. SCAQMD 2003

µg/m^3 = microgram per cubic meter.

ppm = parts per million by volume.

[1] CARB has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

The project site is located within the SFBAAB, which includes all of Alameda, Contra Costa, Marin, Napa, San Mateo, and Santa Clara counties as well as the southern half of Sonoma County and the southwestern portion of Solano County. The region is named as such because its geographical formation surrounding the San Francisco Bay. The Basin is affected by the pollutants generated within dense population centers, heavy vehicular traffic, and industry. However, as mentioned above, coastal sea breezes tend to transport pollutants generated within the SFBAAB to inland locations such as the Central Valley.

The air pollutants within the Basin are generated by two categories of sources: stationary and mobile. Stationary sources are known as "point sources" which have one or more emission sources at a single facility, or "area sources" which are widely distributed and produce many small emissions. Point sources are usually associated with manufacturing and industrial uses and include sources such as refinery boilers or combustion equipment that produce electricity or process heat. Examples of area sources include residential water heaters, painting operations, lawn mowers, agricultural fields, landfills, and consumer products, such as barbecue lighter fluid or hair spray. "Mobile sources" refer to operational and evaporative emissions from on- and off-road motor vehicles.

Local Air Quality

To identify ambient concentrations of the criteria pollutants, the BAAQMD operates more than 30 air quality monitoring stations throughout the Basin. The nearest monitoring station to the project site is located at 822 Alice Street in Oakland, approximately 5 miles southwest of the project site. This monitoring station measures CO and ozone.

Table 4.2-2, Ambient Pollutant Concentrations Measured at Oakland-Alice Street Station by Year, lists the concentrations registered and the exceedances of California Ambient Air Quality Standards (CAAQS) and the NAAQS that have occurred at this monitoring station from 2001 through 2005. Although limited 2006 data are available from other air monitoring stations, 2001 through 2005 data were used in order to provide complete coverage of air pollutants monitored at the Alice Street station. In addition, 2006 air quality data from the Alice Street monitoring station have not yet been fully reviewed and compiled for public access. During this period (i.e., 2001 to 2005), the station did not register any days above the state 1-hour or federal 8-hour ozone standard. At the closest monitoring station that monitors PM_{10} (Arkansas Street station in San Francisco), the state 24-hour PM_{10} standard was exceeded each year except for 2005. At the same Arkansas Street station, the federal 24-hour $PM_{2.5}$ standard was exceeded in 2001 and 2002, but no exceedances were registered between 2003 and 2005. No other exceedances of the state or federal standards for NO_2, CO, SO_2, or Pb were registered at this station between 2001 and 2005.

Table 4.2-2
Ambient Pollutant Concentrations Measured at Oakland-Alice Street Station by Year

Pollutant	Standards[1]	Year 2001	2002	2003	2004	2005
OZONE (O_3)						
Maximum 1-hour concentration (ppm)		0.069	0.053	0.081	0.080	0.068
Maximum 8-hour concentration (ppm)		0.043	0.043	0.054	0.057	0.045
Number of days exceeding state 1-hour standard	0.09 ppm	0	0	0	0	0
Number of days exceeding federal 8-hour standard	0.08 ppm	0	0	0	0	0
CARBON MONOXIDE (CO)						
Maximum 1-hour concentration (ppm)		5.0	4.4	3.9	3.5	3.4
Maximum 8-hour concentration (ppm)		3.98	3.34	2.78	2.64	2.44
Number of days exceeding state 8-hour standard	9.0 ppm	0	0	0	0	0
Number of days exceeding federal 8-hour standard	9 ppm	0	0	0	0	0
NITROGEN DIOXIDE (NO_2)[2]						
Maximum 1-hour concentration (ppm)		0.062	0.080	0.056	0.063	0.066
Annual Average (ppm)		na	0.019	na	0.017	0.016
Number of days exceeding state 1-hour standard	0.25 ppm	0	0	0	0	0
SULFUR DIOXIDE (SO_2)[2]						
Maximum 1-hour concentration in ppm		0.010	0.020	0.021	0.044	0.019
Maximum 24-hour concentration in ppm		0.004	0.006	0.009	0.008	0.007
Annual arithmetic mean concentration (ppm)		0.002	0.002	0.003	0.002	0.002
Number of days exceeding state 1-hour standard	0.25 ppm	0	0	0	0	0
Number of days exceeding state 24-hour standard	0.04 ppm	0	0	0	0	0
Number of days exceeding federal 24-hour standard	0.14 ppm	0	0	0	0	0
PARTICULATE MATTER (PM_{10})[3]						
Maximum 24-hour concentration ($\mu g/m^3$)[4]		69.8	78.6	51.7	51.8	46.4
Maximum 24-hour concentration ($\mu g/m^3$)[5]		67.4	74.1	50.8	48.6	44.6
Annual arithmetic mean concentration ($\mu g/m^3$)[5]		26	25	22	22	19
Number of samples exceeding state 24-hour standard	50 $\mu g/m^3$	8	4	1	1	0
Number of samples exceeding federal 24-hour standard	150 $\mu g/m^3$	0	0	0	0	0
PARTICULATE MATTER ($PM_{2.5}$)[3]						
Maximum 24-hour concentration ($\mu g/m^3$)		77	70	41.6	45.8	43.6
Annual arithmetic mean concentration using federal methods ($\mu g/m^3$)		11.5	13.1	10.2	9.9	9.5
Number of samples exceeding federal 24-hour standard[6]	65 $\mu g/m^3$	2	4	0	0	0

Pollutant	Standards[1]	Year 2001	2002	2003	2004	2005
LEAD (Pb)[7]						
Maximum 30-day average concentration (µg/m^3)		0.02	0.02	0.01	—	—
Maximum quarterly average concentration (µg/m^3)		0.01	0.01	0.01	—	—
Number of months exceeding state standard	1.5 µg/m^3	0	0	0	—	—

Sources: (i) California Air Resources Board Air Quality Database http://www.arb.ca.gov/adam/welcome.html
(ii) U.S. Environmental Protection Agency Air Quality Database http://www.epa.gov/air/data/

1 Parts by volume per million of air (ppm), micrograms per cubic meter of air (µg/m^3) or annual arithmetic mean (aam).

2 SO_2 and NO_2 are not monitored at the Alice Street monitoring station. Data for 2001–2003 were obtained from the 6701 International Boulevard monitoring station in Oakland, which is located approximately 8.5 miles southeast of the project site. The 6701 International Boulevard station is the closest monitoring station that monitors for these pollutants. Monitoring for NO_2 and SO_2 was discontinued at the 6701 International station in 2003. Data for 2004 and 2005 were obtained from the Arkansas Street station in San Francisco, the next closest monitoring station located 11 miles west of the project site.

3 Data is from monitoring station in San Francisco at Arkansas Street, the closest monitoring that that monitors that particulate pollutant.

4 Using state methods for sampling.

5 Using federal methods for sampling.

6 The federal $PM_{2.5}$ standard was revised from 65 to 35 µg/m^3 in September 2006. Statistics shown are based on the 65 µg/m^3 standard.

7 Pollutant concentrations were obtained from the Arkansas Street station, the closest monitoring station that monitors for lead.

NOTES:
Sulfates are monitored at Arkansas Street Station, San Francisco. Sulfates have not exceeded the state standard of 25 µg/m^3 for more than 20 years.

Sensitive Receptors

Land uses such as schools, hospitals and convalescent homes are considered relatively sensitive to poor air quality because infants and children, the elderly, and people with health afflictions, especially respiratory ailments, are more susceptible to respiratory infections and other air-quality-related health problems than the general public. Residential areas are also considered sensitive to air pollution because residents (including children and the elderly) tend to be at home for extended periods of time, resulting in sustained exposure to any pollutants present. Recreational areas are also considered sensitive locations due to vigorous exercise associated with these types of land uses (exercise causes an increased breathing rate that will lead to greater exposure to ambient air pollutants).

Meteorological conditions in the area result in winds that tend to blow toward the east, southeast, and northeast. Sensitive land uses in the vicinity of the proposed project include residential neighborhoods, open space recreational areas, university student dormitories, and day care centers. Residential neighborhoods are located along the western and northern boundary of the proposed project. The nearest residences are approximately 600 feet away.

The UC Berkeley campus lies west of the project site. Sensitive land uses on the campus, which are in proximity of the project site, include a dormitory, Foothill Student Housing facility, and a day care facility, which is located in Girton Hall. The open space areas of Strawberry Canyon (owned by

University of California) are located southeast of the project site. Other open-space areas include the University of California's Ecological Study Area and the Botanical Garden, the 2,000-acre Tilden Regional Park to the northeast, and the 208-acre Claremont Canyon Regional Preserve, which is located to the southeast of the project site.

Localized Carbon Monoxide Concentrations

Traffic congestion along roadways and at intersections has the potential to generate localized high levels of CO. The BAAQMD monitoring stations have not recorded any exceedances of the state or federal CO standards since 1991. However, because elevated CO concentrations are generally localized, heavy traffic volumes and congestion at specific intersections or roadway segments can lead to high levels of CO, or hotspots, while concentrations at the nearest air quality monitoring station may be below state and federal standards.

Surrounding Land Uses

The proposed project site is surrounded by residential neighborhoods, UC Berkeley campus, recreational areas, university dormitories, and daycare centers. Major sources of air pollutants associated with these uses include motor vehicle emissions, natural gas combustion for water and space heating, and periodic landscape maintenance. It is not anticipated that surrounding land uses would result in emissions that would have a significant impact on the employees of the proposed project.

Global Climate Change

Description of Greenhouse Effect

Heat retention within the atmosphere is an essential process to sustain life on Earth. An important natural process through which heat is retained in the troposphere[1] is called the "greenhouse effect". The greenhouse effect traps heat in the troposphere through a three-fold process as follows: Short-wave radiation emitted by the Sun is absorbed by the Earth; the Earth emits a portion of this energy in the form of long-wave radiation; and greenhouse gases (GHGs) in the upper atmosphere absorb this long-wave radiation and emit this long-wave radiation into space and toward the Earth. This "trapping" of the long-wave (thermal) radiation emitted back toward the Earth is the underlying process of the greenhouse effect. Without the greenhouse effect, it is estimated that the Earth's average temperature would be approximately -18 degrees Celsius (°C) (0° Fahrenheit [°F]) instead of its present 14°C (57°F) (National Climatic Data Center 2006). The most abundant GHGs are water vapor and carbon dioxide. Many other

1 The troposphere is the bottom layer of the atmosphere, which varies in height from the Earth's surface to 10 to 12 kilometers).

trace gases have greater ability to absorb and re-radiate long-wave radiation; however, these gases are not as plentiful. For this reason, and to gauge the potency of GHGs, scientists have established a Global Warming Potential (GWP) for each GHG based on its ability to absorb and re-radiate long-wave radiation. The GWP of a gas is determined using carbon dioxide as the reference gas with a GWP of 1.

Greenhouse Gases

Primary Greenhouse Gases

Greenhouse gases include, but are not limited to, the following (IPCC 1996)[2]:

- Carbon dioxide (CO_2). Carbon dioxide associated with human activity is generated primarily by fossil fuel combustion in stationary and mobile sources. Due to the emergence of industrial facilities and mobile sources in the past 250 years, the concentration of carbon dioxide in the atmosphere has increased 35 percent (U.S. EPA 2006). Carbon dioxide is the most widely-emitted anthropogenic GHG and is the reference gas (GWP of 1) for determining GWPs for other GHGs. In 2004, 83.8 percent of California's GHG emissions were carbon dioxide (CEC 2006).

- Methane (CH_4). Methane is emitted from biogenic sources, incomplete combustion in forest fires, landfills, manure management, and leaks in natural gas pipelines. In the United States, the top three sources of methane come from landfills, natural gas systems, and enteric fermentation (U.S. EPA 2006). Methane is the primary component of natural gas, which is used for space and water heating, steam production, and power generation. The GWP of methane is 21.

- Nitrous oxide (N_2O). Nitrous oxide is produced by both natural and human-related sources. Primary human-related sources include agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuel, adipic acid production, and nitric acid production. The GWP of nitrous oxide is 310.

- Hydrofluorocarbons (HFCs). HFCs are typically used as refrigerants for both stationary refrigeration and mobile air conditioning. The use of HFCs for cooling and foam blowing is growing as the continued phase-out of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) gains momentum. The GWP of HFCs range from 140 for HFC-152a to 6,300 for HFC-236fa.

- Perfluorocarbons (PFCs). PFCs are compounds consisting of carbon and fluorine. They are primarily created as a byproduct of aluminum production and semiconductor manufacturing. PFCs are potent GHGs with a GWP several thousand times that of carbon dioxide, depending on the specific PFC. Another area of concern regarding PFCs is their long atmospheric lifetime (up to 50,000 years) (Energy Information Administration 2001). The GWPs of PFCs range from 5,700 to 11,900.

- Sulfur hexafluoride. Sulfur hexafluoride is a colorless, odorless, nontoxic, nonflammable gas. It is most commonly used as an electrical insulator in high-voltage equipment that transmits and distributes electricity. Sulfur hexafluoride is the most potent GHG that has been evaluated by the

2 All GWPs are given as 100-year GWP. Unless noted otherwise, all GWPs were obtained from the Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change 1996).

Intergovernmental Panel on Climate Change (IPCC) with a GWP of 23,900. However, its global warming contribution is not as high as the GWP would indicate due to its low mixing ratio compared to carbon dioxide (4 parts per trillion [ppt] in 1990 versus 365 ppm) (U.S. EPA 2006).

- Water vapor (H_2O). Although water vapor has not received the scrutiny of other GHGs, it is the primary contributor to the greenhouse effect. Water vapor and clouds contribute 66 to 85 percent of the greenhouse effect (water vapor alone contributes 36 to 66 percent) (Real Climate 2005). Natural processes such as evaporation from oceans and rivers and transpiration from plants contribute 90 percent and 10 percent of the water vapor in our atmosphere, respectively (United States Geological Survey 2006). The primary human-related source of water vapor comes from fuel combustion in motor vehicles; however, this is not believed to contribute a significant amount (less than 1 percent) to atmospheric concentrations of water vapor (Energy Information Administration 2002). Therefore, the control and reduction of water vapor emissions is not within reach of human actions. The IPCC has not determined a GWP for water vapor.

Other Greenhouse Gases

In addition to the six major GHGs discussed above (excluding water vapor), many other compounds have the potential to contribute to the greenhouse effect. Some of these substances were previously identified as stratospheric ozone depletors; therefore, their gradual phase-out is currently in effect. A few of these compounds are discussed below:

- Hydrochlorofluorocarbons (HCFCs). HCFCs are solvents, similar in use and chemical composition to CFCs. The main uses of HCFCs are for refrigerant products and air conditioning systems. As part of the Montreal Protocol, all developed countries that adhere to the Protocol are subject to a consumption cap and gradual phase-out of HCFCs. The United States is scheduled to achieve a 100 percent reduction to the cap by 2030. The GWPs of HCFCs range from 93 for HCFC-123 to 2,000 for HCFC-142b (U.S. EPA 1996).

- 1,1,1-trichloroethane. 1,1,1-trichloroethane or methyl chloroform is a solvent and degreasing agent commonly used by manufacturers. In 1992, the U.S. EPA issued Final Rule 57 FR 33754 scheduling the phaseout of methyl chloroform by 2002 (U.S. EPA 2006). Therefore, the threat posed by methyl chloroform as a GHG continues to diminish. Nevertheless, the GWP of methyl chloroform is 110 times that of carbon dioxide (U.S. EPA 1996).

- Chlorofluorocarbons (CFCs). CFCs are used as refrigerants, cleaning solvents, and aerosol spray propellants. CFCs were also part of the U.S. EPA's Final Rule 57 FR 3374 for the phaseout of ozone depleting substances. Currently, CFCs have been replaced by HFCs in cooling systems and a variety of alternatives for cleaning solvents. Nevertheless, CFCs remain suspended in the atmosphere, contributing to the greenhouse effect. CFCs are potent GHGs with GWPs ranging from 4,600 for CFC-11 to 14,000 for CFC-13 (U.S. EPA 2006).

- Ozone (O_3). Ozone occurs naturally in the stratosphere where it is largely responsible for filtering harmful ultraviolet (UV) radiation. In the troposphere, ozone acts as a GHG by absorbing and re-radiating the infrared energy emitted by the Earth. As a result of the industrial revolution and rising emissions of oxides of nitrogen (NO_X) and volatile organic compounds (VOCs) (ozone precursors), the concentrations of ozone in the troposphere have increased (IPCC 2006). Due to the short life span of ozone in the troposphere, its concentration and contribution as a GHG is not well established. However, the greenhouse effect of tropospheric ozone is considered small, as the radiative forcing of ozone is 25 percent of that of carbon dioxide (IPCC 2007).[3]

Contributions to Greenhouse Gas Emissions

Global

Anthropogenic GHG emissions worldwide as of 2004 (the last year for which data are available for Annex 1 countries) total approximately 29,900 CO_2 equivalent million metric tons ($MMTCO_2E$)[4] with five countries and the European Community (including Germany) accounting for approximately 72 percent of the total (see Table 4.2-3, Six Top GHG Producer Countries and the European Community). It should be noted that inventory data are not all from the same year and may vary depending on the source of the emissions inventory. Furthermore, the GHG emissions in more recent years may be substantially different than those shown in Table 4.2-3.

United States

As noted in Table 4.2-3, the United States was the top producer of greenhouse gas emissions, as of 2004. At that time, six of the states—Texas, California, Pennsylvania, Ohio, Illinois, and Florida, in ranked order—would each rank among the top 30 GHG emitters internationally (World Resources Institute 2006). The primary greenhouse gas emitted by human activities in the United States was CO_2, representing approximately 84 percent of total greenhouse gas emissions (U.S. EPA 2006). Carbon dioxide from fossil fuel combustion, the largest source of U.S. greenhouse gas emissions, accounts for approximately 80 percent of U.S. GHG emissions (U.S. EPA 2006).

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3 Radiative forcing, measured in Watts/m^2, is an externally imposed perturbation (e.g., stimulated by greenhouse gases) in the radiative energy budget of the Earth's climate system (i.e., energy and heat retained in the troposphere minus energy passed to the stratosphere).

4 The CO_2 equivalent emissions are commonly expressed as "million metric tons of carbon dioxide equivalent ($MMTCO_2E$)" The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP, such that $MMTCO_2E$ = (million metric tons of a GHG) x (GWP of the GHG). For example, the GWP for methane is 21. This means that emissions of one million metric tons of methane are equivalent to emissions of 21 million metric tons of CO_2.

Table 4.2-3
Six Top GHG Producer Countries and the European Community

Emitting Countries	2004 GHG Emissions ($MMTCO_2E$)*
United States	7,067.6[1]
China	4,963.1[2]
European Community	4,228.0[1]
Russian Federation	2,086.4[1]
India	1,889.1[2]
Japan	1,355.2[1]
Germany[3]	1015.3[1]
Total:	21,589.4

Sources:
[1] United Nations Framework Convention on Climate Change 2006.
[2] GHG emissions for China and India (Calendar Year 2000) were obtained from the World Resources Institute's Climate Analysis Indicators Tool (CAIT) <http://www.cait.wri.org/cait.php>
[3] Germany's GHG emissions are included in the European Community.
* Excludes emissions/removals from land use, land-use change and forestry (LULUCF)

State of California

Based upon the 2004 GHG inventory data (the latest year available) compiled by the California Energy Commission (CEC) for California and GHG inventories for countries contributing to the worldwide GHG emissions inventory compiled by the United Nations Framework Convention on Climate Change (UNFCCC) for 2004, California's GHG emissions rank second in the United States with emissions of 431 $MMTCO_2E$ (excluding emissions related to imported power) and internationally between Spain (427.9 $MMTCO_2E$) and Australia (529.2 $MMTCO_2E$). However, in terms of the United States, the CEC report ranks California as the fourth lowest per capita emitter of CO_2 from fossil fuel combustion, based on 2001 data.

The CEC report placed CO_2 produced by fossil fuel combustion in California as the largest source of GHG emissions, accounting for 81 percent of the total GHG emissions. CO_2 emissions from other sources contributed 2.8 percent of the total GHG emissions, methane emissions 5.7 percent, nitrous oxide emissions 6.8 percent, and high-GWP gases 2.9 percent (CEC 2006). These high GWP gases are largely composed of refrigerants and a small contribution of sulfur hexafluoride (SF_6) used as insulating materials in electricity transmission and distribution.

The primary contributors to GHG emissions in California are transportation, electric power production from both in-state and out-of-state sources, industry, agriculture and forestry, and other sources that include commercial and residential activities. These primary contributors to California's GHG emissions and their relative contributions are presented in Table 4.2-4, GHG Sources in California.

It should be noted that emissions from each of these economic sectors are not confined to emissions from a single process, since there is crossover with other sectors. For example, the GHG emissions from cement production places clinker (nodules formed by the heat processing of cement elements in a kiln) manufacturing in its own category and the fuel used to heat the cement production process within the industrial fuel category. In the case of landfills, methane emissions and CO_2 emissions and sinks are reported in their respective portions of the inventory. Taken together, the CO_2 sinks approximately offset the landfill methane emissions. Additionally, fuel-related GHG emissions from transporting wastes to landfills are included in transportation fuels.

Table 4.2-4
GHG Sources in California[1]

Source Category	Annual GHG Emissions ($MMTCO_2E$)[a]	Percent of Total	Annual GHG Emissions ($MMTCO_2E$)[b]	Percent of Total
Transportation	200.1	40.7%	200.1	46.4%
Electric Power Production	109.2	22.2%	48.4	11.2%
Industry	100.9	20.5%	100.9	23.4%
Agriculture & Forestry	40.9	8.3%	40.9	9.5%
Other	40.9	8.3%	40.9	9.5%
Total	492.0	100.0%	431.2	100.0%

Sources:
[1] CEC 2006.
[a] Includes emissions associated with imported electricity, which account for 60.8 $MMTCO_2E$ annually.
[b] Excludes emissions associated with imported electricity.

Global Climate Change

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer) (U.S. EPA 2006). Climate change may result from:

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system (e.g., changes in ocean circulation, reduction in sunlight from the addition of GHG and other gases to the atmosphere from volcanic eruptions); and

- Human activities that change the atmosphere's composition (e.g., through burning fossil fuels) and the land surface (e.g., deforestation, reforestation, urbanization, and desertification).

Effects of Global Climate Change

The primary effect of global climate change has been a rise in average global tropospheric temperature of 0.2° Celsius per decade, determined from meteorological measurements worldwide between 1990 and 2005 (IPCC 2007). Climate change modeling using 2000 emission rates shows that further warming would occur, which would induce further changes in the global climate system during the current century (IPCC 2007). According to the Intergovernmental Panel on Climate Change, changes to the global climate system and ecosystems and to California could include, but would not be limited to:

- the loss of sea ice and mountain snowpack resulting in higher sea levels and higher sea surface evaporation rates with a corresponding increase in tropospheric water vapor due to the atmosphere's ability to hold more water vapor at higher temperatures (IPCC 2007);
- a rise in global average sea level primarily due to thermal expansion and melting of glaciers and ice caps, and the Greenland and Antarctic ice sheets (IPCC 2007);
- changes in weather that include widespread changes in precipitation, ocean salinity, and wind patterns, and more energetic aspects of extreme weather including droughts, heavy precipitation, heat waves, extreme cold, and the intensity of tropical cyclones (IPCC 2007);
- the decline of Sierra snowpack, which accounts for approximately half of the surface water storage in California, by 70 percent to as much as 90 percent over the next 100 years (CalEPA 2006);
- an increase in the number of days conducive to ozone formation by 25 to 85 percent (depending on the future temperature scenario) in high ozone areas of Los Angeles and the San Joaquin Valley by the end of the 21st century (CalEPA 2006); and
- high potential for erosion of California's coastlines and sea water intrusion into the Delta and associated levee systems due to the rise in sea level (CalEPA 2006).

4.2.3 Regulatory Considerations

Air quality within the SFBAB is addressed through the efforts of various federal, state, regional and local government agencies. These agencies work jointly as well as individually to improve air quality through legislation, regulations, planning, policymaking, education, and a variety of programs. With respect to the proposed project, the BAAQMD would administer most of the air quality requirements affecting the CRT Facility. The agencies primarily responsible for improving the air quality within the Basin are discussed in the following pages, along with their individual responsibilities.

United States Environmental Protection Agency

Criteria Pollutants

The United States Environmental Protection Agency is responsible for enforcing the federal Clean Air Act (CAA) and the NAAQS. The NAAQS identify levels of air quality for seven criteria pollutants that are considered the maximum levels of ambient (background) air pollutants considered safe, with an adequate margin of safety, to protect the public health and welfare. The seven criteria pollutants are ozone, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and Pb. Particulate matter is the general term used for a mixture of solid particles and liquid droplets found in the air. For air quality purposes, these particles are classified by size: fine particulates ($PM_{2.5}$) have a diameter less than or equal to 2.5 micrometers, and respirable or coarse particulates (PM_{10}) have a diameter less than or equal to 10 micrometers. The federal ambient air quality standards and the relevant health effects of the criteria pollutants are summarized in Table 4.2-1.

The SFBAAB is currently classified by the U.S. EPA as a nonattainment/marginal area for the 8-hour standard for ozone. Additionally, it has been designated as an attainment/unclassifiable area for the 1-hour and 8-hour standards for CO; the 24-hour and annual $PM_{2.5}$ standards; the annual standard for NO_2; and as an attainment area for the quarterly Pb standard and 24-hour and annual SO_2 standards. The SFBAAB is currently designated as unclassifiable for the 24-hour PM_{10} standard. In response to its enforcement responsibilities, the U.S. EPA requires each state to prepare and submit a State Implementation Plan describing how the state will achieve the federal standards by specified dates, depending on the severity of the air quality within the state or air basin. The BAAQMD has been delegated the responsibility for implementing many of the CAA requirements for the region, which includes the Berkeley Lab.

The status of the SFBAAB with respect to attainment with the NAAQS is summarized in Table 4.2-5, National Ambient Air Quality Standards and Status – San Francisco Bay Area Air Basin.

Table 4.2-5
National Ambient Air Quality Standards and Status
San Francisco Bay Area Air Basin

Pollutant	Averaging Time	Designation/Classification
Ozone (O_3)	8 Hour	Nonattainment/Marginal
Carbon Monoxide (CO)	1 Hour, 8 Hour	Attainment/Unclassifiable
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	Attainment/Unclassifiable
Sulfur Dioxide (SO_2)	24 Hour, Annual Arithmetic Mean	Attainment
Respirable Particulate Matter (PM_{10})	24 Hour	Unclassifiable
Fine Particulate Matter ($PM_{2.5}$)	24 Hour, Annual Arithmetic Mean	Attainment/Unclassifiable
Lead (Pb)	Calendar Quarter	Attainment

Source: Environmental Protection Agency. "Region 9: Air Programs, Air Quality Maps." [Online] [July 19, 2007].

Hazardous Air Pollutants

Regulation of hazardous air pollutants (HAPs) under federal regulations is achieved through federal and state controls on individual sources. Federal law defines HAPs as noncriteria air pollutants with short-term (acute) and/or long-term (chronic or carcinogenic) adverse human health effects. The 1990 federal CAA Amendments offer a comprehensive plan for achieving significant reductions in both mobile and stationary source emissions of HAPs. Under the 1990 CAA Amendments, a total of 189 chemicals or chemical families were designated HAPs because of their adverse human health effects. Title III of the 1990 federal CAA Amendments amended Section 112 of the CAA to replace the former program with an entirely new technology-based program. Under Title III, the U.S. EPA must establish maximum achievable control technology emission standards for all new and existing "major" stationary sources through promulgation of National Emission Standards for Hazardous Air Pollutants (NESHAP). Major stationary sources of HAPs are required to obtain an operating permit from the BAAQMD pursuant to Title V of the 1990 CAA Amendments. A major source is defined as one that emits at least 10 tons per year of any HAP or at least 25 tons per year of all HAPs. Neither LBNL nor UC Berkeley is considered a major source.

California Air Resources Board

CARB, a branch of the California Environmental Protection Agency (CalEPA), oversees air quality planning and control throughout California. It is primarily responsible for ensuring implementation of the 1988 California Clean Air Act (CCAA), for responding to the federal CAA requirements and for regulating emissions from motor vehicles and consumer products within the state. CARB has established emission standards for vehicles sold in California and for various types of equipment available commercially. It also sets fuel specifications to further reduce vehicular emissions. The CCAA and other California air quality statutes designate local air districts, such as the BAAQMD, with the responsibility for regulating most stationary sources, and to a certain extent, area sources. CARB is responsible for the regulation of motor vehicles and fuels and some area sources such as consumer products.

Like the U.S. EPA, CARB has established ambient air quality standards for the state (i.e., CAAQS). These standards apply to the same seven criteria pollutants as the federal CAA and also address sulfates (SO_4), visibility-reducing particles, hydrogen sulfide (H_2S) and vinyl chloride (C_2H_3Cl). The CCAA standards are more stringent than the federal standards and, in the case of PM_{10} and SO_2, far more stringent. The CCAA requires air pollution control districts to achieve the state standards by the earliest practicable date.

Based on monitored pollutant levels, the CCAA divides ozone nonattainment areas into four categories—moderate, serious, severe, and extreme—to which progressively more stringent planning and emission control requirements apply.

The Basin is a nonattainment area for the California 1-hour and 8-hour ozone standard. The Basin is designated as nonattainment for the California 24-hour and annual PM_{10} standards, as well as the California annual $PM_{2.5}$ standard. The Basin is designated as attainment or unclassifiable for all other CAAQS. The ozone precursors, reactive organic gases (ROG) and oxides of nitrogen (NO_X), in addition to PM_{10}, are the pollutants of concern for projects located in the Basin. The status of the SFAAB with respect to attainment with the CAAQS is summarized in Table 4.2-6, California Ambient Air Quality Standards and Status – San Francisco Bay Area Air Basin.

Table 4.2-6
California Ambient Air Quality Standards and Status
San Francisco Bay Area Air Basin

Pollutant	Averaging Time	Designation/Classification
Ozone (O_3)	1 Hour, 8 Hour	Nonattainment[1]
Carbon Monoxide (CO)	1 Hour, 8 Hour	Attainment
Nitrogen Dioxide (NO_2)	1 Hour	Attainment
Sulfur Dioxide (SO_2)	1 Hour, 24 Hour	Attainment
Respirable Particulate Matter (PM_{10})	24 Hour, Annual Arithmetic Mean	Nonattainment
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	Nonattainment
Lead (Pb)[2]	30 Day Average	Attainment
Sulfates (SO_4)	24 Hour	Attainment
Hydrogen Sulfide (H_2S)	1 Hour	Unclassified
Vinyl Chloride (C_2H_3Cl)[2]	24 Hour	Unclassified
Visibility Reducing Particles	8 Hour (10 AM–6 PM)	Unclassified

Source: California Air Resources Board. "Area Designations Maps/State and National." [Online] [July 26, 2007]. http://www.arb.ca.gov/desig/adm/adm.htm

1 CARB has not issued area classifications based on the new state 8-hour standard. The previous classification for the 1-hour ozone standard was Serious.

2 CARB has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined.

Toxic Air Contaminants

California law defines toxic air contaminants (TACs) as air pollutants having carcinogenic or other health effects. Assembly Bill (AB) 1807 (the Tanner Bill, passed in 1983) established the State Air Toxics Program and the methods for designating certain chemicals as TACs. A total of 245 substances have been designated TACs under California law; they include the federal HAPs adopted as TACs in accordance with AB 2728. The Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources; AB 2588 does not regulate air toxics emissions directly.

Under AB 2588, sources emitting more than 10 tons per year of any criteria air pollutant must estimate and report their toxic air emissions to the local air districts. Local air districts then prioritize facilities on the basis of emissions, and high priority facilities are required to submit a health risk assessment and communicate the results to the affected public. Depending on risk levels, emitting facilities are required to implement varying levels of risk reduction measures. The BAAQMD is responsible for implementing AB 2588 in the SFBAAB.

The BAAQMD is currently working to control TAC impacts from local hot spots and from ambient background concentrations. The control strategy involves reviewing new sources to ensure compliance with required emission controls and limits, maintaining an inventory of existing sources to identify major TAC emissions and developing measures to reduce TAC emissions. The BAAQMD publishes the results of the various control programs in an annual report, which provides information on the current TAC inventory, AB 2588 risk assessments, TAC monitoring programs, and TAC control measures and plans.

One of the TACs being controlled by the BAAQMD is particulate matter (PM) from diesel-fueled engines, also known as diesel exhaust particulate. In 1998, CARB identified diesel exhaust particulate as a TAC. Compared to other TACs, diesel exhaust particulate emissions are estimated to be responsible for about 70 percent of the total ambient air toxics risk in the Basin. On a statewide basis, the average potential cancer risk associated with these emissions is over 500 potential cancer cases per million exposed people. In addition to these general risks, diesel exhaust particulate can also present elevated localized or near-source exposures. Depending on the activity and nearness to receptors, these potential risks can range from small to 1,500 cancer cases per million exposed people (CARB 2000).

Greenhouse Gas Regulatory Programs

Kyoto Protocol

The original Kyoto Protocol was negotiated in December 1997 and came into force on February 16, 2005. As of June 2007, 174 countries and the European Economic Community have ratified the agreement; however, notably, the U.S. and Australia have not ratified the Protocol. Participating nations are separated into Annex 1 (i.e., industrialized countries) and Non-Annex 1 (i.e., developing countries) countries that have differing requirements for GHG reductions. The goal of the Protocol is to achieve overall emissions reduction targets for six GHGs by the period 2008-2012. The six GHGs regulated under the Protocol are carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs. Each nation has an emissions reduction target under which they must reduce GHG emissions a certain percentage below 1990 levels (e.g., 8 percent reduction for the European Union, 6 percent reduction for Japan). The average reduction target for nations participating in the Kyoto Protocol is approximately five percent below 1990 levels (Pew Center on Global Climate Change No date). Although the United States has not ratified the Protocol, it has established a target of 18 percent reduction in GHG emissions intensity by 2012 (The White House. Addressing Global Climate Change 2007). Greenhouse gas intensity is the ratio of GHG emissions to economic output (i.e., gross domestic product).

Federal Activities

In Massachusetts vs. EPA, the Supreme Court held that U.S. EPA has the statutory authority under Section 202 of the CAA to regulate GHGs from new motor vehicles. The court did not hold that the U.S. EPA was required to regulate GHG emissions; however, it indicated that the agency must decide whether GHGs from motor vehicles cause or contribute to air pollution that is reasonably anticipated to endanger public health or welfare. Upon the final decision, President Bush signed Executive Order 13432 on May 14, 2007, directing the U.S. EPA, along with the Departments of Transportation, Energy, and Agriculture, to initiate a regulatory process that responds to the Supreme Court's decision. The order requires the U.S. EPA to coordinate closely with other federal agencies and to consider the president's Twenty-in-Ten plan in this process. The Twenty-in-Ten plan would establish a new alternative fuel standard that would require the use of 35 billion gallons of alternative and renewable fuels by 2017. The U.S. EPA will be working closely with the Department of Transportation in developing new automotive efficiency standards.

California Activities

AB 1493

In a response to the transportation sector accounting for more than half of California's CO_2 emissions, Assembly Bill 1493 (AB 1493, Pavley) was enacted on July 22, 2002. AB 1493 required CARB to set GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined by the state board to be vehicles whose primary use is noncommercial personal transportation in the state. The bill required that CARB set the GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. In setting these standards, CARB must consider cost-effectiveness, technological feasibility, economic impacts, and provide maximum flexibility to manufacturers. CARB adopted the standards in September 2004. These standards are intended to reduce emissions of carbon dioxide and other greenhouse gases (e.g., nitrous oxide, methane). The new standards would phase in during the 2009 through 2016 model years. When fully phased in, the near-term (2009-2012) standards will result in about a 22 percent reduction in greenhouse gas emissions compared to the emissions from the 2002 fleet, while the mid-term (2013 to 2016) standards will result in a reduction of about 30 percent.

Some currently used technologies that achieve GHG reductions include small engines with superchargers, continuously variable transmissions, and hybrid electric drive.

In December 2004, these regulations were challenged in federal court by the Alliance of Automobile Manufacturers, who claimed that the law regulated vehicle fuel economy, a duty assigned to the federal government. The case had been put on hold by a federal judge in Fresno pending the U.S. Supreme Court's decision in Massachusetts vs. EPA. The U.S. Supreme Court's ruling in favor of the state of Massachusetts has been discussed as a likely vindication of state efforts to control GHG emissions, although there has not yet been a decision regarding AB 1493. Before these regulations may go into effect, the U.S. EPA must grant California a waiver under the federal Clean Air Act, which ordinarily preempts state regulation of motor vehicle emission standards. Following the issuance of the Massachusetts vs. EPA decision, the U.S. EPA announced that it will decide whether to grant California a waiver by December 2007.

Executive Order S-3-05

In June 2005, Governor Schwarzenegger established California's GHG emissions reduction targets in Executive Order S-3-05. The Executive Order established the following goals: GHG emissions should be reduced to 2000 levels by 2010; GHG emissions should be reduced to 1990 levels by 2020; and GHG emissions should be reduced to 80 percent below 1990 levels by 2050. The Secretary of CalEPA (the Secretary) is required to coordinate efforts of various agencies in order to collectively and efficiently reduce GHGs. Some of the agency representatives involved in the GHG reduction plan include the Secretary of the Business, Transportation and Housing Agency, the Secretary of the Department of Food and Agriculture, the Secretary of the Resources Agency, the Chairperson of CARB, the Chairperson of the Energy Commission, and the President of the Public Utilities Commission. The Secretary is required to submit a biannual progress report to the Governor and State Legislature disclosing the progress made toward GHG emission reduction targets. In addition, another biannual report must be submitted illustrating the impacts of global warming on California's water supply, public health, agriculture, the coastline, and forestry, and reporting possible mitigation and adaptation plans to combat these impacts.

AB 32

In furtherance of the goals established in Executive Order S-3-05, the Legislature enacted AB 32 (Nuñez and Pavley), the California Global Warming Solutions Act of 2006, which Governor Schwarzenegger signed on September 27, 2006. AB 32 represents the first enforceable statewide program to limit GHG emissions from all major industries with penalties for noncompliance. CARB has been assigned to carry out and develop the programs and requirements necessary to achieve the goals of AB 32. The foremost objective of CARB is to adopt regulations that require the reporting and verification of statewide GHG emissions. This program will be used to monitor and enforce compliance with the established standards. The first GHG emissions limit is equivalent to the 1990 levels, which are to be achieved by 2020. CARB is also required to adopt rules and regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions. AB 32 allows CARB to adopt market-based compliance mechanisms to meet the specified requirements. Finally, CARB is ultimately responsible for monitoring compliance and enforcing any rule, regulation, order, emission limitation, emission reduction measure, or market-based compliance mechanism adopted. In order to advise CARB, it must convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee. By January 2008, the first deadline for AB 32, a state-wide cap for 2020 emissions based on 1990 levels must be adopted. The following year (January 2009), CARB must adopt mandatory reporting rules for significant sources of GHGs and also a plan indicating how reductions in significant GHG sources will be achieved through regulations, market mechanisms, and other actions.

The first action under AB 32 resulted in the adoption of a report listing early action greenhouse gas emission reduction measures on June 21, 2007. The early actions include three specific GHG control rules. On October 25, 2007, CARB approved to an additional six early action GHG reduction measures under AB 32. These early action GHG reduction measures are to be adopted and enforced before January 1, 2010, along with 32 other climate-protecting measures CARB is developing between now and 2011. The report divides early actions into three categories:

- Group 1 - GHG rules for immediate adoption and implementation
- Group 2 - Several additional GHG measures under development
- Group 3 - Air pollution controls with potential climate co-benefits

The original three adopted early action regulations meeting the narrow legal definition of ”discrete early action GHG reduction measures” include:

- a low-carbon fuel standard to reduce the “carbon intensity” of California fuels;
- reduction of refrigerant losses from motor vehicle air conditioning system maintenance to restrict the sale of ”do-it-yourself” automotive refrigerants; and
- increased methane capture from landfills to require broader use of state-of-the-art methane capture technologies.

The additional six early action regulations adopted on October 25, 2007, also meeting the narrow legal definition of "discrete early action GHG reduction measures," include:

- reduction of aerodynamic drag, and thereby fuel consumption, from existing trucks and trailers through retrofit technology;
- reduction of auxiliary engine emissions of docked ships by requiring port electrification;
- reduction of perfluorocarbons from the semiconductor industry;
- reduction of propellants in consumer products (e.g., aerosols, tire inflators and dust removal products);
- require that all tune-up, smog check and oil change mechanics ensure proper tire inflation as part of overall service in order to maintain fuel efficiency; and
- restriction on the use of SF_6 from non-electricity sectors if viable alternatives are available.

SB 1368

Governor Schwarzenegger, just two days after signing AB 32, reiterated California's commitment to reducing GHGs by signing Senate Bill (SB) 1368. SB 1368 requires the California Energy Commission to develop and adopt regulations for GHG emissions performance standards for the long-term procurement of electricity by local publicly-owned utilities. The California Energy Commission must adopt the standards on or before June 30, 2007. These standards must be consistent with the standards adopted by the California Public Utilities Commission. This effort will help to protect energy customers from financial risks associated with investments in carbon-intensive generation by allowing new capital investments in power plants whose GHG emissions are as low or lower than new combined-cycle natural gas plants, by requiring imported electricity to meet GHG performance standards in California and requiring that the standards be developed and adopted in a public process.

Executive Order S-1-07

On January 18, 2007, California further solidified its dedication to reducing GHGs by setting a new Low Carbon Fuel Standard (LCFS) for transportation fuels sold within the state. Executive Order S-1-07 sets a declining standard for GHG emissions measured in CO_2-equivalent gram per unit of fuel energy sold in California. The target of the LCFS is to reduce the carbon intensity of California passenger vehicle fuels by at least 10 percent by 2020. The LCFS will apply to refiners, blenders, producers, and importers of transportation fuels and will use market-based mechanisms to allow these providers to choose how they reduce emissions during the "fuel cycle" using the most economically feasible methods. The Executive Order requires the Secretary of CalEPA to coordinate with actions of the California Energy Commission, CARB, the University of California, and other agencies to develop a protocol to measure the "life-cycle carbon intensity" of transportation fuels. CARB is anticipated to complete its review of the LCFS protocols no later than June 2007 and implement the regulatory process for the new standard by December 2008.

SB 97

In August 2007, as part of the legislation accompanying the state budget negotiations, the Legislature enacted SB 97 (Dutton), which directs the Governor's Office of Planning and Research (OPR) to develop guidelines under CEQA for the mitigation of greenhouse gas emissions. OPR is to develop proposed guidelines by July 1, 2009, and the Resources Agency is directed to adopt guidelines by January 1, 2010. Until such guidelines are promulgated, there is no guidance from OPR or other agencies regarding the analysis of greenhouse gas emissions in EIRs.

Bay Area Air Quality Management District

Management of air quality in the Basin is the responsibility of the BAAQMD. The BAAQMD is responsible for bringing and/or maintaining air quality in the Basin within federal and air quality standards. Specifically, the BAAQMD has responsibility for monitoring ambient air pollutant levels throughout the Basin and developing and implementing attainment strategies to ensure that future emissions will be within federal and state standards. The following plans have been developed by the BAAQMD to achieve attainment of the federal and state ozone standards. The Clean Air Plan (CAP) and Ozone Strategy fulfill the planning requirements of the CCAA, while the Ozone Attainment Plan fulfills the federal CAA requirements.

Clean Air Plans

As discussed previously, the federal and CCAA require preparation of plans to reduce air pollution to healthful levels. The CCAA requires the air districts within nonattainment areas to prepare a triennial assessments and revisions to their CAPs. The BAAQMD has responded to this requirement by preparing a series of CAPs, the most recent and rigorous of which was approved in December 2000 (BAAQMD 2000) (see also the discussion of the 2005 Ozone Strategy, which continues the series of CCAA attainment plans). The 2000 CAP continues the air pollution reduction strategy established by the 1991 CAP and represents the third triennial update to the 1991 CAP, following previous updates in 1994 and 1997. The 2000 CAP is designed to address attainment of the state standard for ozone. CAPs are intended to focus on the near-term actions through amendments of existing regulations and promulgation of new District regulations.

The 1997 CAP contained stationary and mobile source control measures, which included developing rules to reduce vehicle trips to and from major residential developments, shopping centers and other indirect sources; encouraging cities and counties to plan for high-density development; and clustering development with mixed uses in the vicinity of mass transit stations (BAAQMD 1997). The 2000 CAP includes changes in the organization and scheduling of some existing control measures, some new stationary source control measures, revisions to previous stationary source measures and deletion of some control measures deemed no longer feasible by BAAQMD staff (BAAQMD 2000). The transportation control measures (TCMs) in the 2000 CAP are unchanged from the 1997 CAP. The 2000 CAP continues to discourage urban sprawl while strongly endorsing high-density mixed-use developments near transit centers that reduce the need for commuting by personal vehicles.

2001 Ozone Attainment Plan

The BAAQMD developed the 2001 Ozone Attainment Plan as a guideline to achieve the then federal 1-hour ozone standard (BAAQMD 2001). The 2001 Attainment Plan was approved by CARB in 2001 and by the U.S. EPA in 2003. In April 2004, the U.S. EPA determined the SFBAAB had attained the federal 1-hour ozone standard. Due to the attainment status of the SFBAAB, the 1-hour ozone requirements set forth in the 2001 Ozone Attainment Plan were not required anymore. A year later, in 2005, the federal 1-hour ozone standard was revoked by the U.S. EPA for a new and more health-protective 8-hour standard. The SFBAAB was designated as marginal nonattainment for the federal 8-hour ozone standard. Although designated as nonattainment, areas designated as marginal nonattainment or less were not required to submit new attainment plans. Nonetheless, the control measures and strategies described in the 2001 Ozone Attainment Plan for the 1-hour standard will also help achieve attainment with the 8-hour standard.

2005 Ozone Strategy

The 2005 Ozone Strategy is a comprehensive document mapping how the SFBAAB will achieve attainment of the state 1-hour ozone standard as expeditiously as possible and how the SFBAAB will reduce transport of ozone and ozone precursors to neighboring air basins (BAAQMD 2006). The 2005 Ozone Strategy was prepared by the BAAQMD in cooperation with the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG). The document outlines how the SFBAAB will meet the CCAA planning requirements and transport mitigation requirements through implementation of control measures and strategies. The 2005 Ozone Strategy describes its plans to implement stationary source control measures through District regulations, mobile source control measures through incentive programs; and transportation control measures through transportation programs in cooperation with MTC, transit agencies, and local governments.

Currently, the BAAQMD is developing a 2007 Ozone Strategy that will address achieving attainment for both the state 1-hour and 8-hour ozone standard. The 2007 Ozone Strategy will continue to focus on reducing transport of ozone and ozone precursors to neighboring air basins. In addition, a review of the progress achieved from 2004 to 2006 will be evaluated and used to establish meaningful and effective control measures for 2007 to 2009.

BAAQMD Rules and Regulations

The BAAQMD is responsible for limiting the amount of emissions that can be generated throughout the Basin by stationary sources. Specific rules and regulations have been adopted that limit emissions that can be generated by various uses and/or activities and identify specific pollution reduction measures that must be implemented in association with various uses and activities. These rules regulate not only the emissions of the state and federal criteria pollutants, but also the emissions of toxic air contaminants. The rules are also subject to ongoing refinement by the BAAQMD.

In general, all stationary sources with air emissions are subject to BAAQMD's rules governing their operational emissions. Some emissions sources are further subject to regulation through the BAAQMD's permitting process. Through this permitting process, the BAAQMD also monitors the amount of stationary emissions being generated and uses this information in developing the CAP. Some of the stationary emission sources that would be constructed as part of the project (e.g., cogeneration engines or emergency generator) will be subject to the BAAQMD permitting requirements. A few of the primary BAAQMD rules applicable to the proposed CRT Facility project include the following:

Regulation 2, Rule 1 (General Requirements): This rule requires new and modified sources of air pollution to acquire permits (e.g., Authority to Construct, Permit to Operate) in order to monitor stationary source emissions within the BAAQMD's jurisdiction. The rule also includes a list of equipment and processes that would be exempt from permitting requirements. Among others, these include cooling towers; boilers with a heat input rating less than 10 million British thermal units (BTU) per hour fired exclusively with natural gas, liquefied petroleum gas, or a combination; internal combustion engines with a maximum output rating less than or equal to 50 horsepower.

Regulation 2, Rule 2 (New Source Review): For new and modified stationary sources subject to permitting requirements (see Regulation 2, Rule 1), this series of rules prescribes the use of Best Available Control Technology (BACT) and the provision of emission offsets (i.e., mitigation) for equipment whose emissions exceed specified thresholds. The applicability of these requirements would be determined upon submittal of an application for an Authority to Construct under Regulation 2, Rule 1.

Regulation 2, Rule 5 (New Source Review for Toxic Air Contaminants): For new and modified stationary sources subject to permitting requirements (see Regulation 2, Rule 1) and that would emit TACs, this series of rules prescribes health risk assessment and monitoring requirements. In addition, the use of Best Available Control Technology for Toxics (TBACT) is required for sources with a cancer risk greater than 1 in one million (10^{-6}) and/or a chronic hazard index greater than 0.20. Exemptions to this rule are granted to sources that would emit TAC below the trigger levels (Table 2-5-1 of the Rule) and for emergency standby engines or testing of emergency standby engines.

Regulation 8, Rule 3 (Architectural Coatings): This rule sets limits on the VOC content in architectural coatings sold, supplied, offered for sale, or manufactured within the BAAQMD's jurisdiction. The rule also includes time schedules that specify when more stringent VOC standards are to be enforced. The rule applies during the construction phase of a project. In addition, any periodic architectural coating maintenance operations are required to comply with this rule.

Regulation 8, Rule 15 (Emulsified and Liquid Asphalts): This rule sets limits on the VOC content in emulsified and liquid asphalt used for maintenance and paving operations. The rule includes specific VOC content requirements for various types of asphalt (e.g., emulsified asphalt, rapid-cure liquid asphalt, slow-cure liquid asphalt). This rule applies during the construction phase of a project. In addition, any future asphalt maintenance of a project's roads would be required to comply with the VOC standards set in Rule 15.

Regulation 9, Rule 6 (Nitrogen Oxide Emission from Natural Gas-Fired Water Heaters): This rule sets a limit on the NO_X emissions from natural gas-fired water heaters. The rule applies to natural gas-fired water heaters manufactured after July 1, 1992 with a heat input rating of less than 75,000 BTU/hour. Water heaters subject to the rule must not emit more than 40 nanograms of NO_X per joule of heat output.

Regulation 9, Rule 8 (Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines): This rule limits the NO_X and CO emissions from stationary internal combustion engines. The rule applies to engines rated at greater than 50 brake horsepower, but it exempts emergency generators that would not run for more than 100 hours per year. The cogeneration engines would be subject to BACT, which is more stringent than the limitations in this rule.

BAAQMD CEQA Guidelines

In April 1996, the BAAQMD prepared its BAAQMD CEQA Guidelines as a guidance document to provide lead government agencies, consultants and project proponents with uniform procedures for assessing air quality impacts and preparing the air quality sections of environmental documents for projects subject to CEQA. The BAAQMD CEQA Guidelines were last revised by the BAAQMD in December 1999. This document describes the criteria that the BAAQMD uses when reviewing and commenting on the adequacy of environmental documents, such as this EIR. The BAAQMD CEQA Guidelines recommend thresholds for use in determining whether projects would have significant adverse environmental impacts, identify methodologies for predicting project emissions and impacts, and identify measures that can be used to avoid or reduce air quality impacts. This EIR section was prepared following these recommendations.

Association of Bay Area Governments

ABAG is a council of governments for the Counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano. ABAG is a regional planning agency and serves as a forum for regional issues relating to transportation, the economy, community development and the environment. ABAG also serves as the regional clearinghouse for projects requiring environmental documentation under federal and state law. In this role, ABAG reviews proposed projects to analyze their impacts on ABAG's regional planning efforts.

Although ABAG is not an air quality management agency, it is responsible for several air quality planning issues. Specifically, as the designated Metropolitan Planning Organization for the nine counties, it is responsible, pursuant to Section 176(c) of the 1990 Amendments to the federal CAA, for providing current population, employment, travel and congestion projections for regional air quality planning efforts. ABAG is required to quantify and document the demographic and employment factors influencing expected transportation demand, including land-use forecasts. ABAG is also responsible for preparing and approving the portions of the Basin's CAP relating to demographic projections and integrated regional land use, housing and employment, as well as transportation programs, measures, and strategies.

Local Plans and Policies

The proposed project would be located at LBNL, which is operated by the University of California and conducts work within the University's mission on land that is owned or controlled by The Regents of the University of California. As a state project, the proposed project is exempted by the state constitution from compliance with local land use regulations, including general plans and zoning. However, the proposed project seeks to cooperate with local jurisdictions to reduce any physical consequences of potential land use conflicts to the extent feasible. LBNL is located in the cities of Berkeley and Oakland. The following section summarizes objectives and policies from the 2006 Long Range Development Plan (LRDP), and the City of Berkeley and City of Oakland General Plans that relate to air quality.

2006 LRDP Principles and Strategies[5]

The 2006 LRDP proposed four fundamental principles that form the basis for the development strategies provided for each element of the LRDP. The one principle that is most applicable to air quality is to "Preserve and enhance the environmental qualities of the site as a model of resource conservation and environmental stewardship."

Development strategies provided by the 2006 LRDP are intended to minimize potential environmental impacts that could result from implementation of the 2006 LRDP. Development strategies set forth in the 2006 LRDP that are applicable to air quality include the following:

- Protect and enhance the site's natural and visual resources, including native habitats, streams and mature tree stands by focusing future development primarily within the already developed areas of the site;
- Increase development densities within areas corresponding to existing cluster of development to preserve open space, enhance operational efficiencies and access;
- Site and design new facilities in accordance with University of California Policy on Sustainable Practices to reduce energy, water, and material consumption and provide improved occupant health, comfort and productivity;
- Increase use of alternative modes of transit through improvements to the Laboratory's shuttle bus service;
- Promote transportation demand management strategies such as vanpools and employee ride share programs;
- Maintain or reduce the percentage of parking spaces relative to the adjusted daily population; and
- Consolidate parking into larger lots and/or parking structures, locate these facilities near Laboratory entrances to reduce traffic within the main site.

City of Berkeley General Plan

The City of Berkeley General Plan was adopted on April 23, 2002. The following policies and objectives are contained in the Environmental Management Element of the City of Berkeley General Plan.

Objective 3. Reduce emissions and improve air quality.

5 While this Environmental Impact Report presents a "stand alone" impact analysis that does not rely upon tiering from any programmatic CEQA document, Berkeley Lab does actively follow the 2006 Long Range Development Plan (LRDP) as a planning guide for Lab development. Accordingly, relevant 2006 LRDP principles, strategies, and design guidelines are identified in this section.

Policy EM-18 Regional Air Quality Action: Continue working with the Bay Area Air Quality Management District and other regional agencies to:

1. Improve air quality through pollution prevention methods.

2. Ensure enforcement of air emission standards.

3. Reduce local and regional traffic (the single largest source of air pollution in the City) and promote public transit.

4. Promote regional air pollution prevention plans for business and industry.

5. Promote strategies to reduce particulate pollution from residential fireplaces and wood-burning stoves.

6. Locate parking appropriately and provide adequate signage to reduce unnecessary "circling" and searching for parking.

Policy EM-19 15% Emission Reduction: Global Warming Plan: Make efforts to reduce local [air pollutants] emissions by 15% by the year 2010.

Policy EM-20 City of Berkeley Fleet: The City should exceed Federal and State [air quality] standards for all City fleet vehicles and use all means practical to reduce emissions of criteria pollutants and greenhouse gases.

Policy EM-21 Alternative Fuels: Work with the University of California, the Berkeley Unified School District, and other agencies to establish natural gas fueling and electric vehicle recharging stations accessible to the public.

Policy EM-22 Public Awareness: Increase public awareness of air quality problems, rules, and solutions through use of City publications and networks.

In addition, the following policies from the Transportation Element of the City of Berkeley General Plan are applicable to air quality:

Policy T-10 Trip Reduction: To reduce automobile traffic and congestion and increase transit use and alternative modes in Berkeley, support, and when appropriate require, programs to encourage Berkeley citizens and commuters to reduce automobile trips. The programs that would apply to the proposed project are:

2. Participation in Commuter Check Program.

3. Carpooling and provision of carpool parking and other necessary facilities.

4. Telecommuting programs.

8. Programs to encourage neighborhood-level initiatives to reduce traffic by encouraging residents to combine trips, carpool, telecommute, reduce the number of cars owned, shop locally, and use alternative modes.

9. Programs to reward Berkeley citizens and neighborhoods that can document reduced car use.

10. Limitations on the supply of long-term commuter parking and elimination of subsidies for commuter parking.

Policy T-12 Education and Enforcement: Support, and when possible require, education and enforcement programs to encourage carpooling and alternatives to single-occupant automobile use, reduce speeding, and increase pedestrian, bicyclist, and automobile safety.

Policy T-13 Major Public Institutions: Work with other agencies and institutions, such as the University of California, the Berkeley Unified School District, Vista Community College, and the Alameda County Court, and neighboring cities to promote Eco-Pass and to pursue other efforts to reduce automobile trips.

Policy T-19 Air Quality Impacts: Continue to encourage innovative technologies and programs such as clean-fuel, electric, and low-emission cars that reduce the air quality impacts of the automobile.

Policy T-20 Neighborhood Protection and Traffic Calming: Take actions to prevent traffic and parking generated by residential, commercial, industrial or institutional activities from being detrimental to residential areas.

City of Oakland General Plan

The following transportation-related policies from the City of Oakland General Plan Land Use and Transportation Element would relate to air quality. The Land Use and Transportation Element was approved in March 1998.

Policy T2.1 Encouraging Transit-Oriented Development: Transit-oriented development should be encouraged at existing and proposed transit nodes, defined by the convergence of two or more nodes of public transit such as BART, bus, shuttle services, light rail or electric trolley, ferry, and inter-city or commuter rail.

Policy T2.5 Linking Transportation and Activities: Link transportation facilities and infrastructure improvements to recreational uses, job centers, commercial nodes, and social services (i.e., hospitals, parks, or community centers).

Policy T3.2 Promoting Strategies to Address Congestion: The City should promote and participate in both local and regional strategies to manage traffic supply and demand where unacceptable levels of service exist or are forecast to exist.

Policy T3.5 Including Bikeways and Pedestrian Walks: The City should include bikeways and pedestrian walks in the planning of new, reconstructed, or realigned streets, wherever possible.

Policy T3.6 Encouraging Transit: The City should encourage and promote use of public transit in Oakland be expediting the movement of and access to transit vehicles on designated "transit streets" as shown on the Transportation Plan.

Policy T4.2 Creating Transportation Incentives: Through cooperation with other agencies, the City should create incentives to encourage travelers to use alternative transportation options.

Policy D3.2 Incorporating Parking Facilities: New parking facilities for cars and bicycles should be incorporated into the design of any project in a manner that encourages and promotes safe pedestrian activity.

Policy N1.2 Placing Public Transit Stops: The majority of commercial development should be accessible by public transit. Public transit stops should be placed at strategic locations in the Neighborhood Activity Centers and Transit-Oriented Districts to promote browsing and shopping by transit users.

Policy N5.1: Residential areas should be buffered and reinforced from conflicting uses through the establishment of performance-based regulations, the removal of non-conforming uses, and other tools.

In addition, the Open Space, Conservation, and Recreation (OSCAR) Element of the City of Oakland General Plan includes the following policies that are relevant to air quality. The OSCAR Element of the General Plan was adopted in 1996.

Policy CO-12.1: Promote land use patterns and densities which help improve regional air quality conditions by: (a) minimizing dependence on single passenger autos; (b) promoting projects which minimize quick starts and stops, such as live-work development, and office development with ground-floor retail space; (c) separating land uses which are sensitive to pollution from the sources of air pollution; and (d) supporting telecommuting, flexible work hours, and behavioral changes which reduce the percentage of people in Oakland who must drive to work on a daily basis.

Policy CO-12.3: Expand existing transportation systems management and transportation demand management strategies which reduce congestion, vehicle idling, and travel in single-passenger autos.

Policy CO-12.4: Require that development project be designed in a manner which reduces potential adverse air quality impacts. This may include: (a) the use of vegetation and landscaping to absorb carbon monoxide and to buffer sensitive receptors; (b) the use of low-polluting energy sources and energy conservation measures; (c) designs which encourage transit use and facilitate bicycle pedestrian travel.

Policy CO-12.5: Require new industry to use best available control technology to remove pollutants, including filtering, washing, or electrostatic treatment of emissions.

Policy CO-12.6: Require construction, demolition and grading practices which minimize dust emissions. These practices are currently required by the City and include the following:

- Avoid earth moving and other major dust-generating activities on windy days.
- Sprinkling unpaved construction areas with water during excavation, using reclaimed water where feasible. (Watering can reduce construction-related dust by 50 percent.)
- Covering stockpiled sand, soil, and other particulates with a tarp to avoid blowing dust.
- Covering trucks hauling dirt and debris to reduce spills. If spills do occur, they should be swept up promptly before materials become airborne.
- Preparing a comprehensive dust control program for major construction in populated areas or adjacent to sensitive uses like hospitals and schools.
- Operating construction and earth-moving equipment, including trucks, to minimize exhaust emissions.

Policy CO-12.7: Coordinate local air quality planning efforts with other agencies, including adjoining cities and counties, and the public agencies responsible

4.2.4 Impacts and Mitigation Measures

Significance Criteria

For the purposes of this EIR, air quality impacts would considered significant if they would exceed the following Standards of Significance, which are based on Appendix G of the State CEQA Guidelines, the BAAQMD CEQA Guidelines, and the UC CEQA Handbook. According to these guidelines, a project would normally have a significant impact on air quality if it would:

- conflict or obstruct with implementation of the applicable air quality plan;
- violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);
- expose sensitive receptors to substantial pollution concentrations;
- create objectionable odors affecting a substantial number of people;
- exceed the probability of 10 in one million of a maximally exposed individual contracting cancer due to emissions of toxic air contaminants; or
- have ground level concentrations of non-carcinogenic toxic air contaminants that would result in a Hazard Index greater than 1.0 for the maximally exposed individual.

The UC CEQA Handbook states that, where applicable, the significance criteria established by the applicable air district may be used to make these determinations. The BAAQMD CEQA Guidelines recommend analytical methodologies and provide evaluation criteria for determining the level of significance of project impacts under the above-listed general criteria. The BAAQMD's evaluation criteria for determining air quality impacts provide defined screening thresholds for pollutant emissions. Screening thresholds for air quality impacts from the BAAQMD CEQA Guidelines are presented below.

Construction Emissions

PM_{10} is the pollutant of greatest concern with respect to construction activities. Construction emissions of PM_{10} can vary greatly depending upon the level of activity, construction equipment, local soils and weather conditions, among other factors. As a result, the BAAQMD CEQA Guidelines specify that "[t]he District's approach to CEQA analyses of construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions." Therefore, the determination of significance with respect to construction emissions should be based on a consideration of the control measures to be implemented. If all the applicable control measures for PM_{10} indicated in the BAAQMD CEQA Guidelines would be implemented, then air pollutant emissions from construction activities would be considered less than significant. If a project would not implement all applicable control measures, construction emissions may be considered to result in a significant impact.

Operational Emissions

The BAAQMD CEQA Guidelines recommend that individual project impacts involving direct and/or indirect operational emissions that exceed the following thresholds be considered significant.

- 80 pounds per day of ROG
- 80 pounds per day of NOx
- 80 pounds per day of PM_{10}

Direct emissions are those that are emitted on a site and include stationary sources and on-site mobile equipment, if applicable. Examples of land uses and activities that generate direct emissions are industrial operations and sources subject to an operating permit by the BAAQMD. Indirect emissions come from mobile sources that access the project site, but generally are emitted off site. For many types of land development projects, the principal source of air pollutant emissions is the motor vehicle trips generated by the project.

Local Carbon Monoxide Concentrations

Indirect CO emissions are considered significant if they will contribute to a violation of the state standards for CO (9.0 ppm averaged over 8 hours and 20 ppm over 1 hour). The BAAQMD recommends CO modeling for projects in which: (1) project vehicle emissions of CO would exceed 550 pounds per day; (2) project traffic would affect intersections or roadway segments operating at level of service (LOS) E or F, or would cause a decline to LOS E or F;[6] or (3) project traffic would increase traffic volumes on nearby roadways by 10 percent or more (unless the increase in traffic volume is less than 100 vehicles per hour). Intersections are determined to operate at a LOS between A and E (LOS A being the best and LOS E being the worst) according to congestion or delay time, demand/capacity ratio, and relative flow of traffic at the intersection. Intersections that are determined to operate at a LOS F or E have the potential to cause a CO hotspot (i.e., exceedance of the CAAQS). If necessary, a simplified CO modeling analysis, described in the BAAQMD CEQA Guidelines, may be used to determine localized CO concentrations. If modeling demonstrates that the source would not cause a violation of the state standard at existing or reasonably

6 Levels of Service (LOS) range from A (least congested) with a condition of free flow with low volumes and high speeds to F (most congested) with stop and go, low speed conditions with little or poor maneuverability.

foreseeable receptors, the motor vehicle trips generated by the project would not have a significant impact on local air quality.

Greenhouse Gas Emissions

To date, no local or state air quality agency has adopted significance criteria for GHGs emissions or guidance on how GHGs or global climate change should be addressed in CEQA documents. While the Global Warming Solutions Act (AB 32) created a framework for the reduction of GHGs in California, the Act did not address the role of CEQA in achieving the goals of the act. As noted earlier, in August 2007, the Governor signed SB 97 (Dutton) into law which requires the OPR to prepare CEQA Guidelines for the mitigation of GHG emissions or the effects of greenhouse gas emissions. The Resources Agency must certify and adopt the guidelines by January 1, 2010. Despite the foregoing, this EIR provides a discussion of the cumulative impacts of the project with respect to global climate change in the absence of an established significance threshold.

Impact Assessment Methodology

Air quality impacts resulting from the implementation of the proposed project fall into two categories: short-term impacts due to construction activities and long-term impacts from the day-to-day operations of the proposed project. Construction activities would impact air quality on a local level due to fugitive dust PM_{10} and other criteria pollutant emissions associated with heavy-duty construction equipment exhaust. As mentioned above, compliance with standard control measures specified in the BAAQMD CEQA Guidelines is considered sufficient to reduce construction impacts to a less than significant level.

Following construction of the proposed project, operational criteria pollutant emissions would be generated due to project-related motor vehicle trips. Emissions from on-site stationary and areas sources such as cooling towers, cogeneration engines (or an emergency generator), natural gas combustion for water and space heating, and landscape maintenance equipment will also be generated. Emissions resulting from area sources such as natural gas combustion, landscape maintenance equipment, and periodic architectural coating activities were estimated using URBEMIS2007, a land use and emissions estimation program. URBEMIS2007 was also used to quantify mobile source emissions resulting from the operation of the proposed project. Emissions from on-site stationary sources (i.e., cooling towers, cogeneration engines, an emergency generator) were calculated using emission factors contained in U.S. EPA's Compilation of Air Pollutant Emission Factors (also referred to as AP 42) and the emissions standards for compression-ignition diesel engines established by CARB and the U.S. EPA. The emission calculations and daily emissions are described in further detail below.

Two options are being considered to provide electrical power to the proposed project: (1) install a nominal 3-megawatt cogeneration system with supplemental electrical power from the serving utility, or (2) obtain electrical power from the serving utility and install a 250-kilowatt emergency generator. Thus, stationary source emissions were quantified under two different operating scenarios. The first scenario would involve the installation of two 1.5-megawatt cogeneration engine-generator units. In this situation, the proposed project would generate a portion of its own electrical energy, generate hot water to run absorption chillers (for cooling), and provide backup emergency power for the CRT Facility using the proposed cogeneration engines. Thus, an emergency generator would not be necessary for the first scenario. The second scenario would involve the installation of an emergency generator. In this situation, the proposed project would be provided electrical power from the local serving utility and utilize the emergency generator as a back-up power source. Regardless of the power source, cooling towers, mobile, and area source emissions (e.g., landscape maintenance, natural gas combustion) would be included in the operational emissions.

Mitigation Measures included in the Proposed Project

The following mitigation measures, adopted as part of the 2006 LRDP, are required by the LRDP for the proposed project and are thus included as part of the proposed project. The analysis presented below evaluates environmental impacts that would result from project implementation following the application of these mitigation measures. These mitigation measures that are included in the project would be monitored pursuant to the Mitigation Monitoring and Reporting Plan that will be adopted for the proposed project.

LRDP MM AQ-1a: During construction of the proposed LRDP buildings, the developer must implement all "basic" control measures to minimize the generation of fugitive dust. In addition, for construction sites greater than 4 acres or projects that would generate large amounts of fugitive dust, "enhanced" and "optional" control measures should be implemented. The recommended control measures are located in Table 2 of the BAAQMD CEQA Guidelines.

LRDP MM AQ-1b: During construction of the proposed LRDP buildings, the developer must implement the following mitigation measures to minimize heavy-duty construction equipment exhaust.

- Construction equipment shall be properly tuned and maintained in accordance with manufacturer's specifications.

- Best management construction practices shall be used to avoid unnecessary emissions (e.g., truck and vehicles in loading and unloading queues would turn their engines off when not in use).
- Any stationary motor sources such as generators and compressors located within 100 feet of a sensitive receptor shall be equipped with a supplementary exhaust pollution control system as required by the BAAQMD and CARB.
- Incorporate use of low-NO_X-emitting, low-particulate-emitting, or alternatively fueled construction equipment into the construction equipment fleet where feasible, especially when operating near sensitive receptors.
- Reduce construction-worker trips with ride sharing or alternative modes of transportation.

LRDP MM AQ-4a: To avoid the single location where implementation of the 2006 LRDP would result in an increase in health risk in excess of the 10-in-1-million threshold, LBNL shall adjust, prior to the construction of parking structure PS-1 (or similarly configured building), the exhaust system of the existing generator near Building 90 to reduce or eliminate the restriction on upward exhaust flow caused by the existing rain cap. For example, modeling indicates that removal of the rain cap would reduce the risk caused by construction of parking structure PS-1 in proximity to the existing generator to a level below 10 in 1 million. The Berkeley Lab could install a hinged rain cap, which would prevent moisture infiltration into the generator but still allow unobstructed exhaust flow and would avoid the significant impact identified in the health risk assessment.[5]

Project Impacts and Mitigation Measures

The following sections describe project-specific impacts. A discussion of the cumulative air quality impacts is provided in Section 5.5.2 of the Cumulative Impacts chapter.

CRT Impact AIR-1: Construction of the proposed project would generate short-term emissions of fugitive dust and criteria air pollutants that would not adversely affect local air quality in the vicinity of the construction site. (Less than Significant)

5 While this measure is not specifically applicable to the proposed project, consistency with its provisions regarding the configuration of the emergency generator stack would help to reduce the potential health impacts associated with the emissions from the proposed emergency generator.

Construction of the proposed project is anticipated to commence mid-2008 and continue for approximately 27 months. The project site is currently vacant and would not require demolition operations. Prior to building construction, the entire site would be graded to prepare for asphalt paving and building activities. Fugitive dust PM_{10} would be generated on the project site as a result of earthmoving and grading activities. In addition, criteria air pollutants including ROG and NO_X, among others, would be generated due to heavy-duty construction equipment. Construction activities would also involve asphalt paving for four handicapped parking spaces. The proposed project would not involve the construction of a new parking structure or surface lot. During building construction, emissions would primarily be generated from heavy-duty construction equipment, construction worker trips, and material delivery trips. Although temporary in nature, construction emissions have the potential to cause adverse effects on local air quality in the vicinity of the project site.

The BAAQMD does not require full quantification of construction emissions, but rather emphasizes the implementation of effective and comprehensive control measures to minimize the generation of PM_{10} fugitive dust, ROG, and NO_X. If a proposed project implements all appropriate dust-control measures, the BAAQMD considers construction-related emissions to be less than significant. Implementation of the control measures specified in the BAAQMD CEQA Guidelines (Table 2, Feasible Control Measures for Construction Emissions of PM_{10}), would be sufficient to reduce construction impacts to a less than significant level. Without implementation of the control measures, construction impacts would be considered significant.

The 2006 LRDP EIR included LRDP Mitigation Measure AQ-1a, which is the suite of basic, enhanced and optional control measures recommended in the BAAQMD CEQA Guidelines to minimize the generation of fugitive dust. These measures (basic, enhanced and optional control measures) are incorporated into the proposed project and will be required during the construction of the proposed project. As a result, the project's construction-phase impact related to fugitive dust emissions would be less than significant.

In addition, construction activities would generate air emissions of ROG and NO_X, which are ozone precursors. The magnitude of emissions would vary on a day-to-day basis depending on the heavy-duty construction equipment activity level, number of construction workers, and material delivery trucks. The ozone precursors could potentially contribute to the ongoing nonattainment status of the SFBAAB for ozone. The BAAQMD CEQA Guidelines recognize that construction activities will generate ROG and NO_X; however, these emissions are included in the inventory that is used as the basis for the regional air quality plan. Hence, the emissions have been accounted for and would not be expected to impede attainment or maintenance of ozone in the SFBAAB. Furthermore, the 2006 LRDP EIR included the LRDP Mitigation Measure AQ-1b to minimize the generation of exhaust emissions during construction. This measure is incorporated into the proposed project and will be implemented during the construction of the proposed project. This would ensure that emissions of ozone precursors are minimized during project construction. Project construction activities would also comply with Regulation 8, Rules 3 and 15, related to architectural coatings and emulsified and liquid asphalt. Therefore, the construction emissions would not conflict or obstruct with implementation of the applicable air quality plan and construction-phase project impacts on air quality would be less than significant.

Mitigation Measure: No project-level mitigation measure required.

CRT Impact AIR-2: The proposed project would generate long-term operational emissions of criteria pollutants from increases in traffic and stationary and area sources that would not adversely affect air quality. (Less than Significant)

Operational emissions associated with the day-to-day activities of the proposed project would result from increased vehicular trips to and from the CRT Facility (i.e., mobile sources). Area source emissions associated with the proposed project include the use of natural gas for water and space heating and landscape maintenance equipment. Stationary source emissions include five to nine cooling towers and either an on-site cogeneration facility consisting of two 1.5-megawatt cogeneration engine-generators or one 250-kilowatt emergency generator. The cogeneration facility option would require nine cooling towers (five units for building cooling during hot weather and four units for the cogeneration facility) and the emergency generator option would require five cooling towers for building cooling. As mentioned above, BAAQMD recommends operational thresholds of significance for projects within its jurisdiction. Any project that would generate emissions of ROG, NO_X, or PM_{10} that exceed the thresholds would be considered to have significant operational impacts.

The mobile source emissions associated with the proposed project were estimated using URBEMIS2007. URBEMIS2007 can estimate vehicle emissions based on the amount of development and trip generation rate of the development. In addition, URBEMIS2007 incorporates trip distances and emission factors specific to counties, air basins, and air district jurisdictions. Trip generation rates were obtained from the traffic impact analysis for the proposed project (see Appendix 4.12). For the proposed project, Alameda County specific parameters in URBEMIS2007 were used to estimate mobile and area source emissions. Area source emissions estimated using URBEMIS2007 include natural gas combustion for water and space heating, landscape maintenance equipment, and periodic architectural coating maintenance. The proposed project would be designed to be consistent with the UC Policy for Sustainable Practices, which require new buildings to outperform California Code of Regulations Title 24 standards by at least 20 percent. Although the proposed project's design could exceed Title 24 standards by more than

20 percent, the exact percent is not known at this stage of development. Therefore, area source emissions in URBEMIS2007 were calculated assuming a minimum of 20 percent more efficient than Title 24 would require. Detailed URBEMIS2007 outputs, including parameters and assumptions, are provided in Appendix 4.2.

The proposed project would also include stationary sources such as cooling towers and either an emergency generator or a cogeneration facility. The first electrical supply option would involve a cogeneration facility that would provide a portion of electrical power required for the CRT Facility with most of the power provided by the local serving utility. The cogeneration facility would consist of two 1.5-megawatt cogeneration engines that would generate a total of 3 megawatts for the proposed project's energy demand. Criteria pollutant emissions associated with the cogeneration engines were calculated using the estimated ROG, NO_X, and CO emissions provided by the emission control equipment manufacturer, and a PM_{10} emission factor from the CARB Guidance for Permitting of Electrical Generation Technologies (CARB 2002). Cogeneration engine emission factors for SO_X were obtained from U.S. EPA AP 42 (U.S. EPA 2000). The emissions associated with operation of the cogeneration facility are included in the stationary source category in Table 4.2-7, Estimated Operational Emissions – CRT Facility with On-Site Cogeneration.

In the second electrical supply option (i.e., emergency generator scenario), the proposed project would be connected to the on-site electrical distribution system to provide its electrical power from the regional grid. In this situation, a 250-kilowatt emergency generator would be installed on site to provide power for basic building functions in the case of an electricity outage in the area. Criteria pollutant emissions associated with the emergency generator were calculated using emission standards for off-road diesel (compression-ignition) engines established by CARB and the U.S. EPA (California Code of Regulations 2000). Because the engine has an output rating greater than 50 horsepower, this unit must comply with CARB's Airborne Toxics Control Measure (ATCM) for stationary compression-ignition engines (California Code of Regulations 2005). The ATCM requires that new emergency standby engines must comply with hydrocarbon, NO_X, and CO limits that are applicable to an off-road engine of the same model year and horsepower rating. The ATCM further limits the PM emissions from an emergency standby engine to either (1) 0.15 grams per horsepower-hour (g/hp-hr) (with a maximum operating limit of 50 hours per year for testing and maintenance) or 0.01 g/hp-hr (with a maximum operating limit of 100 hours per year for testing and maintenance), or (2) the emission limit for an off-road engine with the same maximum rated power, whichever is more stringent. For the ratings of the proposed engine, assuming a 2010 model year or later, the 0.15 g/hp-hr limit is the applicable PM limit under California and federal standards for off-road engines; however, LBNL has proposed to meet the more stringent emission standard of 0.01 g/hp-hr and would restrict the operating hours to 50 hours per year for testing and maintenance. Since June 2006, the sulfur content of available CARB diesel fuel has been 15 ppm (0.0015 percent) by weight, and this concentration was used to estimate the SO_X emissions from the proposed engine. The criteria pollutant emissions associated with the operation of the 250-kilowatt emergency generator are included in the stationary source category in Table 4.2-8, Estimated Operational Emissions – CRT Facility with Emergency Generator.

The proposed project would operate five to nine cooling towers with a maximum circulating water flow rate of 1,465 gallons per minute and a standard flow rate of 735 gallons per minute. The emissions associated with daily operation of the cooling towers were calculated using the maximum flow rate to represent a worst-case day scenario. The emissions associated with cooling towers were calculated using emission factors contained U.S. EPA's AP 42 (U.S. EPA 1995). The cooling tower emissions associated with the proposed project are included in the stationary source category in Table 4.2-7 and Table 4.2-8 for the cogeneration facility scenario and emergency generator scenario, respectively. Detailed calculations of each stationary source are included in Appendix 4.2.

Under BAAQMD Regulation 2, Rule 2 (New Source Review), an applicant for an Authority to Construct must comply with the applicable offset requirements. Before the BAAQMD can issue an Authority to Construct for a new source at a facility that emits or will be permitted to emit more than 10 tons per year, but less than 35 tons per year of precursor organic compounds (POC, equivalent to ROG) or NO_X, offsets must be provided at a 1.0 to 1.0 ratio for the new source's emissions plus any pre-existing cumulative increase[7] and all existing sources of POC and/or NOx are equipped with Best Available Retrofit Control Technology (BARCT). Generally, the offsets are provided by the BAAQMD from its Small Facility Banking account. If the account has been exhausted, the applicant must provide the offsets, usually by purchasing emission reduction credits from another party. The account currently has sufficient credits to fully fund the offset requirements for the proposed project. Based on the values shown in Table 4.2-7, together with existing emissions from permitted sources at LBNL, the ROG and NO_X emissions would not exceed 10 tons per year.[8] Thus, if the cogeneration facility were to be constructed, the ROG and NO_X emissions would not have to be offset. Offsets for PM_{10} and SO_X emissions are required only for those major facilities whose emissions of these pollutants exceed 100 tons per year. This threshold would not

7 The cumulative increase is the aggregate sum of all increases in emissions of any given pollutant from a facility pursuant to Authorities to Construct or Permits to Operate issued after April 5, 1991, excluding emissions from a source that has lost its permit exemption.

8 The cumulative increase in emissions for LBNL to date has not been quantified; however, the reported ROG and NO_X emissions for LBNL in 2005 were each approximately 0.6 tons per year (CARB Facility Search for Lawrence Berkeley National Lab [Online] [September 24, 2007] <http://www.arb.ca.gov/app/emsinv/facinfo/facinfo.php>). When added to the proposed stationary source emissions shown in Table 4.2-7 on an annual basis (5.7 tons of ROG per year and 2.7 tons of NO_X per year), the total cumulative increase in emissions would be well below the offset trigger level of 10 tons per year.

be exceeded for PM_{10} or SO_X, so this requirement would not be applicable. No offsets are required for CO emissions.

Table 4.2-7
Estimated Operational Emissions – CRT Facility with On-Site Cogeneration

	Emissions in Pounds per Day				
Emissions Source	ROG	NO_X	CO	SO_X	PM_{10}
Summertime Emissions[1]					
Stationary Sources					
Cogeneration	31.12	14.52	20.75	0.39	4.15
Cooling Towers	—	—	—	—	4.24
Stationary Source Subtotal	31.12	14.52	20.75	0.39	8.39
Operational (Mobile) Sources	2.89	2.48	23.50	0.02	3.44
Area Sources	0.82	0.62	2.06	0.00	0.01
Summertime Emission Totals	34.83	17.62	46.31	0.41	11.84
BAAQMD Thresholds	80	80	—	—	80
Exceeds Threshold?	NO	NO	—	—	NO
Wintertime Emissions[2]					
Stationary Sources					
Cogeneration	31.12	14.52	20.75	0.39	4.15
Cooling Towers	—	—	—	—	4.24
Stationary Source Subtotal	31.12	14.52	20.75	0.39	8.39
Operational (Mobile) Sources	2.03	3.64	24.46	0.02	3.44
Area Sources	0.70	0.60	0.51	0.00	0.00
Wintertime Emission Totals	33.85	18.76	45.72	0.41	11.83
BAAQMD Thresholds	80	80	—	—	80
Exceeds Threshold?	NO	NO	—	—	NO

Source: Impact Sciences, Inc. Emissions calculations are provided in Appendix 4.2.
Totals in table may not appear to add exactly due to rounding in the computer model calculations.
1 "Summertime Emissions" are representative of the conditions that may occur during the ozone season (May 1 to October 31).
2 "Wintertime Emissions" are representative of the conditions that may occur during the balance of the year (November 1 to April 30).

As shown above, operational emissions associated with the day-to-day activities of the proposed project, after offsets for the emissions from the cogeneration facility are provided in accordance with BAAQMD rules, would not exceed the ROG, NO_X, or PM_{10} operational thresholds of significance. Projects that generate emissions less than the regional thresholds of significance would not be considered to contribute a substantial amount of air pollutants. Therefore, operational emissions would be considered a less-than-significant impact, and the project would not contribute substantially to the existing ozone and PM_{10} nonattainment status for the SFBAAB.

As shown below, operational emissions associated with the day-to-day activities of the proposed project with the emergency generator would not exceed the operational thresholds of significance for ROG, NO_X, or PM_{10}. Projects that generate emissions below the thresholds of significance would not be considered to contribute a substantial amount of air pollutants. Therefore, the CRT Facility's operational emissions would not result in a significant impact, and the project would not contribute substantially to the existing ozone and PM_{10} nonattainment status for the SFBAAB.

Mitigation Measure: No project-level mitigation measure required.

Table 4.2-8
Estimated Operational Emissions – CRT Facility with Emergency Generator

	Emissions in Pounds per Day				
Emissions Source	ROG	NO_X	CO	SO_X	PM_{10}
Summertime Emissions[1]					
Stationary Sources					
Emergency Generator	0.78	2.33	2.02	0.00	0.01
Cooling Towers	—	—	—	—	2.36
Stationary Source Subtotal	0.78	2.33	2.02	0.00	2.37
Operational (Mobile) Sources	2.89	2.48	23.50	0.02	3.44
Area Sources	0.82	0.62	2.06	0.00	0.01
Summertime Emission Totals	4.49	5.43	27.58	0.02	5.82
BAAQMD Thresholds	80	80	—	—	80
Exceeds Threshold?	NO	NO	—	—	NO
Wintertime Emissions[2]					
Stationary Sources					
Emergency Generator	0.78	2.33	2.02	0.00	0.01
Cooling Towers	—	—	—	—	2.36
Stationary Source Subtotal	0.78	2.33	2.02	0.00	2.37
Operational (Mobile) Sources	2.03	3.64	24.46	0.02	3.44
Area Sources	0.70	0.60	0.51	0.00	0.00
Wintertime Emission Totals	3.51	6.57	26.99	0.02	5.81
BAAQMD Thresholds	80	80	—	—	80
Exceeds Threshold?	NO	NO	—	—	NO

Source: Impact Sciences, Inc. Emissions calculations are provided in Appendix 4.2.
Totals in table may not appear to add exactly due to rounding in the computer model calculations.
[1] "Summertime Emissions" are representative of the conditions that may occur during the ozone season (May 1 to October 31).
[2] "Wintertime Emissions" are representative of the conditions that may occur during the balance of the year (November 1 to April 30).

CRT Impact AIR-3: The proposed project would increase carbon monoxide concentrations at busy intersections and along congested roadways in the project vicinity but would not expose sensitive receptors to substantial pollutant concentrations. (Less than Significant)

CO is produced in greatest quantities from vehicle combustion and is usually concentrated at or near ground level under cool, stable (i.e., low or no wind) atmospheric conditions because it does not readily disperse into the atmosphere. As a result, potential air quality impacts to sensitive receptors are assessed through an analysis of localized CO concentrations. Traffic congested roadways and intersections have the potential to generate high localized levels of CO. Congested intersections, roadways, and parking structures where high ambient concentrations of CO accumulate are termed CO "hotspots." These hotspots have the potential to exceed the state ambient air quality 1-hour CO standard of 20 ppm or the 8-hour CO standard of 9.0 ppm. Note that the federal levels are based on 1- and 8-hour standards of 35 and 9 ppm, respectively. Thus, an exceedance condition would occur based on the state standards prior to exceedance of the federal standard. As such, exceedance of the state ambient air quality 1-hour standard of 20 ppm or the 8-hour standard of 9.0 ppm would constitute a significant air quality impact from the creation of substantial concentrations of CO.

The project was evaluated to determine if it would cause a CO hotspot utilizing a simplified CALINE4 screening model developed by the BAAQMD. The simplified model is intended as a screening analysis that identifies a potential CO hotspot. If a hotspot is identified, the complete CALINE4 model is then utilized to determine precisely the CO concentrations predicted at the intersections in question. This methodology assumes worst-case conditions (i.e., wind direction is parallel to the primary roadway and 90 degrees to the secondary road, wind speed of less than one meter per second and extreme atmospheric stability) and provides a screening of maximum, worst-case, CO concentrations. This model was utilized to predict future CO concentrations 0 and 25 feet from the intersections in the study area based on projected traffic volumes for these intersections contained in the project traffic study. These intersections were determined in the project traffic study to operate at LOS D or worse. Intersections operating at a LOS of E or F are considered to have the potential to create a CO hotspot. However, for the purposes of this analysis, any intersections operating at a LOS D or worse (i.e., Centennial Drive and Grizzly Peak Boulevard) were analyzed. Maximum CO concentrations occurring during cumulative plus project conditions were calculated for peak hour traffic volumes. The results of these CO concentration calculations are presented in Table 4.2-9 Cumulative (2025) Plus CRT Project CO Concentrations, for representative receptors located 0 and 25 feet from the intersection.

As shown below, the contribution of traffic from cumulative projects plus the proposed project traffic would not generate CO concentrations near the study intersections that would exceed any of the state CO ambient air quality standards. Therefore, the project's impact would be considered less than significant and the project would not expose sensitive receptors to substantial pollutant concentrations. The day-to-day operations of the proposed project would not violate or contribute substantially to an air quality violation.

Mitigation Measure: No project-level mitigation measure required.

Table 4.2-9
Cumulative (2025) Plus CRT Project CO Concentrations

Intersection	0 Feet		25 Feet	
	1-Hour [1]	8-Hour [2]	1-Hour [1]	8-Hour [2]
Centennial Drive and Grizzly Peak Boulevard	7.1	4.4	6.9	4.3
Gayley Avenue/La Loma Avenue and Hearst Avenue	7.3	4.6	7.1	4.4
Gayley Avenue and Stadium Rim Way	7.3	4.6	7.1	4.4
Piedmont Avenue and Bancroft Way	7.2	4.5	7.0	4.4
Piedmont Avenue and Durant Avenue	7.2	4.5	7.0	4.4

Source: Impact Sciences, Inc.
Emissions calculations are provided in Appendix 4.2.
[1] State 1-hour and 8-hour standards are 20 parts per million and 9.0 parts per million, respectively.
[2] Federal 1-hour and 8-hour standards are 35 parts per million and 9 parts per millions, respectively.

CRT Impact AIR-4: The proposed project would not create objectionable odors affecting a substantial number of people. (Less than Significant)

The proposed project would consist of computational equipment and office space to support UC Berkeley's academic programs in computational science and engineering. The CRT Facility would not include laboratories that would generate odors or gases that require fume hoods. Therefore, the proposed project is not anticipated to generate any substantial odors associated with its operation and would be considered a less than significant impact.

In addition, LBNL provides an extensive buffer zone around most of the Laboratory's perimeter. This established buffer zone for potential sources of odors is consistent with the 2005 Ozone Strategy. It should also be noted that LBNL has no previous history of odor complaints and the proposed project would not generate any odors in the project area. Furthermore, the proposed project would maintain a 50-foot no-build zone from Blackberry Canyon as well as a 40-foot setback from adjacent structures to minimize any potential impact on adjoining neighborhoods. Therefore, the project's impact with respect to odors is less than significant.

Mitigation Measure: No project-level mitigation measure required.

CRT Impact AIR-5: The proposed project would not expose maximally exposed individuals to cancer risks exceeding 10 in one million. (Less than Significant)

A human health risk assessment (HHRA) was prepared to evaluate the emissions of TACs from potential air emission sources for two potential project configurations (Golder 2007):

Configuration 1: Nine cooling towers and two 1.5-megawatt natural-gas-fired cogeneration units

Configuration 2: Five cooling towers and one 250-kilowatt diesel emergency generator

For each configuration, estimated TAC emissions from the sources associated with the CRT Facility were screened with respect to their relative emission rates and toxicity (i.e., cancer potency) so that the TACs resulting in greater than 90 percent of the total toxicity-weighted cancer-causing emissions were included in the HHRA for the project. These TACs were thus identified as chemicals of potential concern (COPCs) for the HHRA. The sources, specific COPCs evaluated in the HHRA for cancer effects, and annual quantities are shown in Table 4.2-10, Summary of Configuration 1 Annual COPC Emissions (Carcinogens) and Table 4.2-11, Summary of Configuration 2 Annual COPC Emissions (Carcinogens). The methods used to calculate the emissions of all TACs emitted and the screening of COPCs are described in the HHRA, which is on file with the Berkeley Lab.

Table 4.2-10
Summary of Configuration 1 Annual COPC Emissions (Carcinogens)

Source(s)	Chemical	Annual COPC Emissions (Pounds/Year)
Cogeneration Units	1,3-Butadiene	51.8
Cogeneration Units	Formaldehyde	665.0

Source: Golder Associates 2007

Table 4.2-11
Summary of Configuration 2 Annual COPC Emissions (Carcinogens)

Source(s)	Chemical	Annual COPC Emissions (Pounds/Year)
Diesel Generator	Diesel Particulate Matter	0.39

Source: Golder Associates 2007

The U.S. Environmental Protection Agency-approved AMS/EPA Regulatory Model (AERMOD) model was used to model the air quality impacts of COPC emissions from the proposed CRT project configurations. The AERMOD model can estimate the air quality impacts of single or multiple sources using actual meteorological conditions. The specific exhaust parameters for the cooling towers, cogeneration units, and the emergency generator are described in the HHRA, which is on file with the Berkeley Lab.

The model was configured with the following control parameters:

- Modeling switches: regulatory defaults,
- Averaging periods: annual, and
- Choice of dispersion coefficients based upon land-use type: rural.

Meteorological data from an on-site monitoring station at LBNL for 1998 and 1999 were used in AERMOD. Rural dispersion coefficients were selected because they result in higher ambient concentrations than urban coefficients, and both rural and urban land use types exist within and outside of the LBNL facility site.

Two separate receptor grids were created for this project: one grid containing only receptor locations on, or inside of, the LBNL facility property boundaries (On-site Grid), and the second grid containing only receptor locations beyond, or outside of, the LBNL facility property boundaries (Off-site Grid). The receptor grids were created by first overlaying a rectilinear grid of receptor locations extending approximately 200 meters out from the facility property boundary with even 30-meter spacing between receptor locations. An additional grid of receptors with 180-meter spacing was extended from the edge of the 30-meter grid to a distance of at least one kilometer out from the facility property boundary to ensure that all maximum off-site concentrations would be captured in the modeling simulation.

A set of property boundary receptors was also generated by creating receptor locations every 50 meters along the LBNL facility property boundary.

A detailed description of the modeling methodology and results is provided in the HHRA, which is on file with the Berkeley Lab.

The cancer risk calculations were performed using the exposure and risk equations in the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) guidance manual for health risk assessments prepared under the Air Toxics "Hot Spots" program (OEHHA 2003). The potential exposure pathways assessed included inhalation only. Dermal (skin), soil ingestion, ingestion of homegrown produce, and mother's milk exposure pathways were not assessed as these pathways were not considered to be significant sources of potential human health risk given the emission sources and the location of the proposed project (see the HHRA for further discussion of this issue). The cancer risk calculations for off-site residential exposures were based on COPC concentrations predicted at locations in the Off-site Grid and assumed that a person is exposed continuously for 70 years (9 years as a child and 61 years as an adult). This approach is intended to result in conservative (i.e., health protective) estimates of health impacts. The cancer risk calculations for on-site worker receptors were based on COPC concentrations predicted at locations in the On-site Grid and used the assumed breathing rates and exposure periods in the OEHHA guidance manual (e.g., 8 hours per day, 245 days per year, 40 years). Cancer risks were evaluated using the inhalation Cancer Potency Factors published by CARB and OEHHA (CARB/OEHHA 2006).

Table 4.2-12, Summary of Configuration 1 Maximum Modeled Cancer Risks and Table 4.2-13, Summary of Configuration 2 Maximum Modeled Cancer Risks, shows the maximum cancer risk due to COPC emissions from the CRT Facility for both configurations at any of the on-site and off-site receptors evaluated in the AERMOD modeling.

Table 4.2-12
Summary of Configuration 1 Maximum Modeled Cancer Risks

Receptor	Cancer Risk
On-Site	
Worker	3×10^{-6}
Off-Site	
Child/Adult Resident	1×10^{-6}

Source: Golder Associates 2007

Table 4.2-13
Summary of Configuration 2 Maximum Modeled Cancer Risks

Receptor	Cancer Risk
On-Site	
Worker	0.03×10^{-6}
Off-Site	
Child/Adult Resident	0.03×10^{-6}

Source: Golder Associates 2007

As shown in these tables, the maximum on-site and off-site cancer risks resulting from the proposed project's TAC emissions from either configuration would be less than the BAAQMD significance threshold of 10 in one million (10×10^{-6}). Accordingly, the project impacts on human health with respect to the cancer risk threshold would be less than significant.

Mitigation Measure: No project-level mitigation measure required.

CRT Impact AIR-6: The proposed project would not generate ground level concentrations of non-carcinogenic toxic air contaminants that would result in a Hazard Index greater than 1.0 for the maximally exposed individual. (Less than Significant)

The human health risk assessment described above also evaluated the emissions of TACs from the emission sources proposed at the CRT Facility under either configuration with respect to their noncancer health effects (Golder Associates 2007). In addition to the potential cancer risk, TACs have acute (i.e., short-term) and chronic (i.e., long-term) noncancer health impacts.

For the chronic noncancer assessment for each configuration, estimated TAC emissions from the sources associated with the CRT Facility were screened with respect to their relative emission rates and chronic toxicity (i.e., chronic noncancer reference exposure levels [RELs]) so that the TACs resulting in greater than 90 percent of the total chronic noncancer toxicity-weighted emissions were included in the HHRA for the project. These TACs were thus identified as COPCs for the HHRA. The sources, specific COPCs evaluated in the HHRA for chronic noncancer effects, and annual quantities are shown in Table 4.2-14, Summary of Configuration 1 Annual COPC Emissions (Chronic Noncarcinogens) and Table 4.2-15, Summary of Configuration 2 Annual COPC Emissions (Chronic Noncarcinogens). The methods used to calculate the emissions of all TACs emitted and the screening of COPCs are described in the HHRA, which is on file with the Berkeley Lab.

Table 4.2-14
Summary of Configuration 1 Annual COPC Emissions
(Chronic Noncarcinogens)

Source(s)	Chemical	Annual COPC Emissions (Pounds/Year)
Cogeneration Units	Formaldehyde	665.0
Cogeneration Units	Acrolein	8.3

Source: Golder Associates 2007

Table 4.2-15
Summary of Configuration 2 Annual COPC Emissions
(Chronic Noncarcinogens)

Source(s)	Chemical	Annual COPC Emissions (Pounds/Year)
Cooling Towers	Bromine Compounds[1]	0.20
Diesel Generator	Diesel Particulate Matter	0.39

Source: Golder Associates 2007

[1] Sodium bromide is an ingredient of the cooling tower treatment products currently being used at LBNL. To provide a conservative estimate of the project's health impacts, it is assumed that the same products may be used in the CRT cooling towers. However, LBNL expects to use a non-chemical treatment system for the cooling towers at the CRT Building.

Acute impacts from the emission sources associated with this project were not assessed. Acute RELs are not published by CARB/OEHHA for bromine compounds (the only TAC estimated to be emitted from the cooling towers), so no acute assessment of TAC emissions from the cooling towers was possible. For combustion sources (i.e., natural-gas-fired cogeneration units and diesel generator), it is expected that chronic health effects from their emissions (especially cancer risk) will dominate the health concerns. Since the cancer risk for both configurations of this project were insignificant (as were chronic noncancer hazards, as shown below), there was no reason to pursue an acute hazard assessment. The methods used to calculate the emissions of all TACs assessed are described in the HHRA, which is on file with the Berkeley Lab.

The chronic hazard indices were evaluated using the CARB/OEHHA inhalation RELs (CARB/OEHHA 2006). The REL is the concentration (inhalation) at or below which no adverse health effects are anticipated. The hazard quotient is the ratio of the modeled concentration of a TAC to its REL. The hazard quotients for TACs affecting the same target organ or organ system (e.g., skin, eyes, nervous system, gastrointestinal system) are typically added together to compute a hazard index, although for this assessment all hazard quotients were conservatively added without regard to target organ.

The chronic noncancer hazard quotients for the proposed project were calculated by dividing the maximum annual average concentrations of the COPCs (predicted by the AERMOD model) by their RELs. Table 4.2-16, Summary of Configuration 1 Maximum Modeled Chronic Noncancer Health Impacts and Table 4.2-17, Summary of Configuration 2 Maximum Modeled Chronic Noncancer Health Impacts, shows the maximum chronic hazard indices due to COPC emissions from the CRT Facility at on-site and off-site receptors.

Table 4.2-16
Summary of Configuration 1 Maximum Modeled Chronic Noncancer Health Impacts

Receptor	Chronic Hazard Index
On-Site	
Worker	0.4
Off-Site	
Resident	0.02

Source: Golder Associates 2007

Table 4.2-17
Summary of Configuration 2 Maximum Modeled Chronic Noncancer Health Impacts

Receptor	Chronic Hazard Index
On-Site	
Worker	0.0003
Off-Site	
Resident	0.00003

Source: Golder Associates 2007

As shown in these tables, the maximum on-site and off-site chronic impacts resulting from the proposed project's TAC emissions from either configuration would be less than the BAAQMD significance threshold of 1.0. Accordingly, the project impacts on human health with respect to acute health impacts would be less than significant.

Mitigation Measure: No project-level mitigation measure required.

4.2.5 References

Bay Area Air Quality Management District. '97 Clean Air Plan and Triennial Assessment. December 1997.

Bay Area Air Quality Management District. BAAQMD CEQA Guidelines [for] Assessing the Air Quality Impacts of Projects and Plans. December 1999.

Bay Area Air Quality Management District. 2000 Clean Air Plan and Triennial Assessment. December 2000.

Bay Area Air Quality Management District. Revised San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard. October 2001.

Bay Area Air Quality Management District. Bay Area 2005 Ozone Strategy. January 2006.

California Air Resources Board, Guidance for Permitting of Electrical Generation Technologies, July 2002.

California Air Resources Board and Office of Environmental Health Hazard Assessment. "Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values." [Online] [October 5, 2006]. <http://www.arb.ca.gov/toxics/healthval/healthval.htm>.

California Code of Regulations, Title 13, Section 2421 et seq., Off-Road Compression-Ignition Engines and Equipment. December 2000.

California Code of Regulations, Title 17, Section 93115, Airborne Toxic Control Measure for Stationary Compression Ignition (CI) Engines.

California Energy Commission. Inventory of California Greenhouse Gas Emissions and Sinks 1990 to 2004. Figure 2. December 2006. <http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-SF.PDF>

California Energy Commission. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. December 2006.

California Environmental Protection Agency, Climate Action Team. Climate Action Team Report to Governor Schwarzenegger and the Legislature (Executive Summary). March 2006.

California Environmental Quality Act Guidelines. California Code of Regulations, Title 14, Division 6, Chapter 3.

Energy Information Administration. Alternatives to Traditional Transportation Fuels 1994. July 2002. <http://www.eia.doe.gov/cneaf/alternate/page/environment/exec2.html>

Energy Information Administration. Other Gases: Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride. October 2001. <http://www.eia.doe.gov/oiaf/1605/gg00rpt/other_gases.html>

Golder Associates. Human Health Risk Assessment in Support of an Environmental Impact Report: Computational Research Theory Building Project – Lawrence Berkeley National Laboratory. September 2007.

Intergovernmental Panel on Climate Change. Climate Change 1995: The Science of Climate Change – Contribution of Working Group I to the Second Assessment Report of the IPCC. Cambridge (UK): Cambridge University Press. 1996.

Intergovernmental Panel on Climate Change. Climate Change 2001: Tropospheric Ozone. March 2006. <http://www.grida.no/climate/ipcc_tar/wg1/142.htm>

Intergovernmental Panel on Climate Change. Climate Change 2007: The Physical Science Basis, Summary for Policymakers. February 2007. <http://ipcc-wg1.ucar.edu/wg1/docs/WG1AR4_SPM_PlenaryApproved.pdf>

National Climatic Data Center. Global Warming Frequently Asked Questions. February 2006. <http://www.ncdc.noaa.gov/oa/climate/globalwarming.html>

Office of Environmental Health Hazard Assessment. Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. August 2003.

Pew Center on Global Climate Change. Bush Policy vs. Kyoto. http://www.pewclimate.org/what_s_being_done/in_the_world/bush_intensity_targe_2.cfm

Real Climate. Water Vapour: Feedback or Forcing?. April 2005. <http://www.realclimate.org/index.php?p=142>

South Coast Air Quality Management District. Final Program Environmental Impact Report to the 2003 Draft AQMP, August 2003, Table 3.1-1, p. 3.1-2. [Online] http://www.aqmd.gov/ceqa/documents/2003/aqmd/finalEA/aqmp/AQMP_FEIR.html [March 21, 2007].

United Nations Framework Convention on Climate Change. National Greenhouse Gas Inventory Data for the Period 1990 – 2004 and Status of Reporting. November 2006. <http://unfccc.int/ghg_emissions_data/predefined_queries/items/3841.php>

United States Environmental Protection Agency. Compilation of Air Pollutant Emission Factors (AP 42), Fifth Edition. Volume I: Chapter 13.4 Wet Cooling Towers. January 1995. <http://www.epa.gov/ttn/chief/ap42/final/c13s04.pdf>

United States Environmental Protection Agency. Protection of Stratospheric Ozone: Listing of Global Warming Potential for Ozone-Depleting Substances. January 1996. <http://www.epa.gov/fedrgstr/EPA-AIR/1996/January/Day-19/pr-372.html>

United States Environmental Protection Agency. Compilation of Air Pollutant Emission Factors (AP 42), Fifth Edition. Volume I: Chapter 3.3 Gasoline and Diesel Industrial Engines. October 1996. <http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>

United States Environmental Protection Agency. Compilation of Air Pollutant Emission Factors (AP 42), Fifth Edition. Volume I: Chapter 1.4 Natural Gas Combustion. July 1998. <http://www.epa.gov/ttn/chief/ap42/ final/c01s04.pdf>

U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors (AP 42), Fifth Edition. Volume I: Chapter 3.2 Natural Gas-Fired Reciprocating Engines. July 2000. <http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s02.pdf>

United States Environmental Protection Agency. "Greenhouse Gas Emissions from a Typical Passenger Vehicle", Office of Transportation and Air Quality, EPA420-F-05-004. February 2005. p. 4.

United States Environmental Protection Agency. Class I Ozone Depleting Substances. March 2006. <http://www.epa.gov/ozone/ods.html>

United States Environmental Protection Agency. Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2004. April 2006. <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

United States Environmental Protection Agency. The Accelerated Phase-Out of Class 1 Ozone-Depleting Substances. April 2006. <http://www.epa.gov/ozone/title6/phaseout/accfact.html>

United States Environmental Protection Agency. Methane: Sources and Emissions. October 2006. <http://www.epa.gov/methane/sources.html>

United States Environmental Protection Agency. High GWP Gases and Climate Change. October 2006. <http://www.epa.gov/highgwp/scientific.html#sf6>

United States Environmental Protection Agency. Glossary of Climate Change Terms. <http://www.epa.gov/climatechange/glossary.html#Climate_change> [Online] [November 30, 2006]

United States Geological Survey. The Water Cycle: Evaporation. August 2006. <http://ga.water.usgs.gov/edu/watercycleevaporation.html>

University of California, Office of the President. University of California CEQA Handbook. July 2001.

The White House. Addressing Global Climate Change. March 2007. <http://www.whitehouse.gov/ceq/global-change.html>

World Resources Institute. How U.S. State GHG Emissions Compare Internationally. <http://earthtrends.wri.org/updates/node/106> [Online] [November 13, 2006]