Chapter 8. Air Quality

8.1 Overview

This chapter describes the regional setting of ARC, including climatic and meteorological conditions, and summarizes measured air pollutant concentrations representative of existing project conditions. It also summarizes applicable federal, state, and local air quality regulations as well as relevant plans, policies, and measures that address air quality effects of operations and future development at ARC. Information presented in this chapter was obtained from the November 2009 NASA ARC ERD (NASA 2009), NADP EIS (Design, Community & Environment 2002), state and regional air quality management authorities, and other sources.

8.2 Regulatory Background

8.2.1 Federal and State Air Quality Standards

Both the federal government and the State of California have established ambient air quality standards for “criteria” pollutants (Table 8-1). These criteria pollutants now include carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), particulate matter with a diameter less than 10 microns (PM_{10}) and those with a diameter of 2.5 microns or less ($PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). The air pollutants for which standards have been established are considered the most prevalent air pollutants known to be hazardous to human health. Besides the six criteria air pollutants described above, there is another group of substances found in ambient air referred to as toxic air contaminants. These contaminants (hydrogen sulfide (H_2S), vinyl chloride (C_2H_3Cl), and sulfates (SO_4)) tend to be localized and are found in relatively low concentrations in ambient air. However, they can result in adverse chronic health effects if exposure to low concentrations occurs for long periods. They are regulated at the local, state, and federal levels.

Table 8-1. Federal and State Air Quality Standards

Pollutant	Symbol	Average Time	Standard (ppm) California	Standard (ppm) National	Standard (µg/m³) California	Standard (µg/m³) National	Attainment Status California	Attainment Status National
Ozone	O_3	1 hour	0.09	NA	180	NA	N1	N2
		8 hours	0.07	0.075	137	147	N	See note # 3
Carbon monoxide	CO	8 hours	9	9	10,000	10,000	A	A4
		1 hour	20	35	23,000	40,000	A	A
Nitrogen dioxide	NO_2	Annual average	0.030	0.053	57	100	A	U
		1 hour	0.18	0.1	339	188	NA	A
Sulfur dioxide	SO_2	Annual average	NA	0.03	NA	80		A
		24 hours	0.04	0.14	105	365	A	A
		1 hour	0.25	0.075	655	196	A	A
Hydrogen sulfide	H_2S	1 hour	0.03	NA	42	NA	U	NA
Vinyl chloride	C_2H_3Cl	24 hours	0.01	NA	26	NA	NA	NA
Inhalable particulate matter	PM_{10}							
		Annual arithmetic mean	NA	NA	20		N5	NA
		24 hours	NA	NA	50	150	NA	N
	$PM_{2.5}$							
		Annual arithmetic mean	NA	NA	12	15	N5	A
		24 hours	NA	NA	NA	65	NA	N
Sulfate particles	SO_4	24 hours	NA	NA	25	NA	A	NA
Lead particles	Pb	Calendar quarter	NA	NA	NA	1.5	NA	A
		30-day average	NA	NA	1.5	NA	NA	A
		Rolling 3 Month Average	NA	NA	NA	0.15	NA	See note #6

Pollutant	Symbol	Average Time	Standard (ppm) California	National	Standard (μg/m³) California	National	Attainment Status California	National

Notes:
All standards are based on measurements at 25ºC and 1 atmosphere pressure.
National standards shown are the primary (health effects) standards.
NA = not applicable.
A = Attainment
N = Nonattainment
U = Unclassified
μg/m³ = micrograms per cubic meter
1. The 8-hour CA ozone standard was approved by the Air Resources Board on April 28, 2005 and became effective on May 17, 2006.4. Final designations effective July 20, 2012.
2. Final designations effective July 20, 2012.
3. The national 1-hour ozone standard was revoked by U.S. EPA on June 15, 2005.
4. In April 1998, the Bay Area was redesignated to attainment for the national 8-hour carbon monoxide standard.
5. In June 2002, CARB established new annual standards for $PM_{2.5}$ and PM_{10}.
6. National lead standard, rolling 3-month average: final rule signed October 15, 2008. Final designations effective December 31, 2011.
Sources: CARB 2013; BAAQMD 2014a.

8.2.2 Federal Regulations

8.2.2.1 *Clean Air Act*

The Clean Air Act of 1970 (CAA) was enacted by Congress to protect air quality in the United States. The CAA is implemented through air pollution laws administered and enforced by the U.S. Environmental Protection Agency (EPA). However the EPA has largely delegated the task of administering air pollution laws to the states.

The CAA also requires EPA to set National Ambient Air Quality Standards (NAAQS). These standards limit the concentrations of certain pollutants in the ambient air. The limits set for these pollutants, called criteria air pollutants, include both primary and secondary limits or standards. Primary standards were established to protect the public's health and secondary standards were established to prevent environmental and property damage. Currently, there are six criteria pollutants limited by NAAQS: CO, NO_2, O_3, PM, SO_2, and Pb.

The EPA designates an area as being in "attainment" for a pollutant if its concentration in ambient air does not exceed the NAAQS for that pollutant over a certain time period. If an area does not meet one of the NAAQS over a 3-year period, the EPA designates it as a "nonattainment" area for that particular pollutant. EPA requires states with nonattainment areas to prepare and submit air quality plans showing how the standards will be met in the future or, if they cannot be met, how they can show progress toward meeting the standards. These air quality plans are referred to as state implementation plans (SIPs). Under severe cases, EPA may impose a federal plan.

8.2.2.1.1 General Conformity

Section 176(c) of the 1990 CAA Amendments outlines the "conformity" provisions for federal projects. Federal actions are required to conform to the requirements of a SIP, and must not jeopardize efforts for a region to achieve NAAQS. Section 176(c) assigns primary oversight responsibility for conformity assurance to the federal agency undertaking the project, not the EPA, state, or local agency. For there to be conformity, federally supported or funded activities must not: (1) cause or contribute to any new air quality standard violation, (2) increase the frequency or severity of any existing standard violation, or (3) delay the timely attainment of any standard, interim emission reduction, or other SIP milestone aimed at bringing the region into attainment.

In 1993, EPA issued conformity regulations (40 CFR Parts 51 and 93) that addressed transportation projects (Transportation Conformity) and conformity of all other non-transportation federal actions (General Conformity). The primary requirements of the Transportation Conformity rule are that implementation of transportation plans or programs cannot produce more emissions of pollutants than budgeted in the latest SIP.

The General Conformity regulations apply to a wide range of federal actions or approvals that would cause emissions of criteria air pollutants above specified levels to occur in locations designated as nonattainment or maintenance areas. Since the Bay Area is in nonattainment (nonclassified) for O_3 and is a CO maintenance area, federal projects are subject to the General Conformity regulations if they generate emissions of O_3 precursor pollutants (volatile organic compounds [VOCs] and nitrogen oxide [NOx]) or CO in excess of approximately 91 tonnes (100 tons) per year, or if the emissions are more than 10% of the nonattainment or maintenance area's emission inventory for the pollutant of concern.

Projects that are subject to the General Conformity regulations are required to mitigate or fully offset the emissions caused by the action, including both direct and indirect (for example, traffic) emissions that the federal agency has some control over. BAAQMD adopted and incorporated the Transportation and General Conformity regulations into the SIP in 1994.

8.2.2.1.2 Title V

Title V of the 1990 CAA Amendments (sections 501-507) requires large industrial facilities to apply for federal operating permits. These permits list all of the federal CAA and state and local air quality requirements that apply to the facility, and describe the monitoring and recordkeeping requirements that are needed to ensure compliance. Under Title V, a major source is defined as a facility with actual or potential emissions that meet or exceed the major source threshold for its location. The major source threshold for any "air pollutant" is 100 tons/year. Major source thresholds for "hazardous air pollutants" (HAP) are 10 tons/year for a single HAP or 25 tons/year for any combination of HAP.

If a permitted facility can keep its potential to emit (the maximum physical and operational capacity of a source to emit any air pollutant) below Title V definition thresholds for a major source, it may apply for a Synthetic Minor Operating Permit (SMOP) through the local air quality management authority. A major source has actual or potential emissions that meet or exceed the major source threshold for their location. The EPA has authorized BAAQMD to issue Title V permits to facilities in the Bay Area.

8.2.2.2 *National Environmental Policy Act*

NEPA requires federal agencies to include in their decision-making process appropriate and careful consideration of all environmental effects of a proposed action and of possible alternative actions. Measures to avoid or minimize the adverse effects of proposed actions and to restore and enhance environmental quality as much as possible must be developed and discussed where feasible.

8.2.3 State Regulations

The California Clean Air Act (CCAA) of 1988, amended in 1992, outlines a program for areas in the state to attain the California Ambient Air Quality Standards (CAAQS) by the earliest practical date. The CCAA sets more stringent air quality standards for all of the pollutants covered under national standards. It also regulates levels of C_2H_3Cl, hydrogen sulfide, sulfates, and visibility-reducing particulates. If an area does not meet CAAQS, CARB designates the area as a nonattainment area. Based on the California standards, the Bay Area is a serious nonattainment area for O_3 (since the area cannot forecast attainment of the state O_3 standard in the foreseeable future). CARB requires regions that do not meet CAAQS for O_3 to submit clean air plans that describe plans to attain the standard. The Bay

Area is also a state nonattainment area for PM_{10}. The Bay Area has met CAAQS for all other air pollutants.

8.2.4 Local and Regional Regulations

The local air quality regulatory agency responsible for the San Francisco Bay Area Air Basin is BAAQMD. BAAQMD regulates stationary sources (with respect to federal, state, and local regulations), monitors regional air pollutant levels (including measurement of toxic air contaminants), develops air quality control strategies, and conducts public awareness programs. BAAQMD has also developed California Environmental Quality Act (CEQA) guidelines that establish significance thresholds and provide guidance for evaluating potential air quality impacts of projects and plans.

BAAQMD has prepared the Bay Area Clean Air Plan (CAP) to address the California Clean Air Act. This plan includes a comprehensive strategy to reduce emissions from stationary, area, and mobile sources, and attain the stricter state air quality standard mandated by the California Clean Air Act. CAP is designed as a multi-pollutant plan to protect public health and the climate. The 2010 CAP serves as the triennial updated to the Bay Area ozone plan for state air quality planning purposes. The primary objective of the 2010 CAP is to define control strategies that the BAAQMD and its partners will implement to: (1) reduce emissions and decrease ambient concentrations of harmful pollutants; (2) safeguard public health by reducing exposure to air pollutants that pose the greatest health risk, with an emphasis on protecting the communities most heavily impacted by air pollution; and (3) reduce GHG emissions to protect the climate (BAAQMD 2010a).

BAAQMD Regulation 2, Rule 6, Major Facility Review, gives BAAQMD the authority to issue permits to a major facility, defined as a facility with the “potential to emit" more than 100,000 tons per year of GHG and 100 tons per year of a regulated air pollutant. Major facilities that are willing to accept federally enforceable permit conditions that limit emissions to less than Title V thresholds can apply for SMOP.

In order to be eligible for a SMOP, a site must either have a maximum potential to emit that is less than each Title V emission threshold (less than 95 tons per year of NOx, CO, precursor organic compounds (POC), PM_{10}, and SO_2, less than 9 tons per year) of any HAP, and less than 23 tons per year of all HAPS combined) or must accept conditions limiting the site to less than these emissions thresholds (BAAQMD Regulation 2-6-423). In addition for a facility to be eligible for a SMOP for GHG emissions, the emission threshold is 90% of the Title V emission threshold, or 90,000 tons per year of carbon dioxide equivalent (CO_2E) emissions, or must accept conditions limiting the site to less than these emissions thresholds (BAAQMD Regulation 2-6-423.2.2).

8.3 Regional Setting

ARC is a federal facility located on approximately 800 hectares (2,000 acres) of land between U.S. Highway 101 and the southwestern edge of the San Francisco Bay in the northern portion of Santa Clara County, California (Figures 1-1 and 1-2). The City of Mountain View borders it to the south and west, and the City of Sunnyvale to the south and east. ARC is about 56 kilometers (35 miles) south of San Francisco and 16 kilometers (10 miles) north of San Jose, in the heart of Silicon Valley. For planning purposes, ARC is divided into four subareas: the NASA Research Park, Eastside/Airfield, Bay View, and the Ames campus (Figure 1-3).

8.3.1 Regional Topography and Climate

ARC is located in the San Francisco Bay Area Air Basin, which includes the City of San Francisco, portions of Sonoma and Solano counties, and all of San Mateo, Santa Clara, Alameda, Contra Costa, Marin, and Napa counties.

The climate at ARC is characterized by warm, dry summers and cool, moist winters. The proximity of the San Francisco Bay and the Pacific Ocean has a moderating influence on the climate. The major synoptic feature controlling the area's climate is a large high-pressure system located in the eastern Pacific Ocean known as the Pacific High. The strength and position of the Pacific High varies seasonally. It is at its strongest when it is located off the West Coast of the United States during the summer. Large-scale atmospheric subsidence associated with the Pacific High produces an elevated temperature inversion along the West Coast. The base of this inversion is usually located from 300 to 1,000 meters (984 to 3,281 feet) above mean sea level, depending on the intensity of subsidence and the prevailing weather condition. Vertical mixing is often limited to the base of the inversion, trapping air pollutants in the lower atmosphere. Marine air trapped below the base of the inversion is often condensed into fog or stratus clouds by the cool Pacific Ocean. This condition is typical of the warmer months of the year, from roughly May through October. Stratus clouds usually form offshore and move into the Bay Area during the evening hours. As the land warms the following morning, the clouds often dissipate, except in areas immediately adjacent to the coast. The stratus then redevelops and moves inland late in the day. Otherwise, clear skies and dry conditions prevail during summer.

As winter approaches, the Pacific High becomes weaker and shifts south, allowing pressure systems associated with the polar jet stream to affect the region. Low-pressure systems produce periods of cloudiness, strong shifting winds, and precipitation. The number of days with precipitation can vary greatly from year to year, resulting in a wide range of annual precipitation totals. Precipitation is generally lowest along the coastline and bay, with the highest amounts occurring along south- and west-facing slopes. Annual precipitation totals for ARC ranged from about 150 to 790 millimeters (6 to 31 inches) during the 1945-1993 period of record, with an annual average of 343 millimeters (13.5 inches). About 90% of rainfall in the region occurs between November and April. High-pressure systems in winter can produce cool stagnant conditions. Radiation fog and haze are common during extended winter periods when high-pressure systems influence the weather.

The annual average high temperatures at ARC are 68° Fahrenheit (F)/20° Centigrade (C). Annual average low temperatures are 50°F/10°C. In July, the average high and low temperatures are 75°F and 57°F (25°C and 13°C), respectively, while in January the average high and low temperatures are 57°F and 42°F (13°C and 6°C). Extreme high and low temperatures recorded during the 48-year period of record were 105°F and 21°F (40°C and 6°C), respectively. Temperatures along the Bay Area are generally less extreme compared to inland locations due to the moderating effect of the Pacific Ocean. The proximity of the Eastern Pacific High and relatively lower pressure inland produces a prevailing west to northwest sea breeze along the central and northern California coast for most of the year. As this wind is channeled through the Golden Gate Bridge and other gaps, it branches off to the northeast and southeast, following the general orientation of the San Francisco Bay. As a result, the wind prevails from the north to northwest in the South Bay region and ARC during daytime hours. Nocturnal winds and land breezes during the colder months of the year prevail from the south due to drainage out of the Santa Clara Valley.

During the fall and winter months, the Pacific High can combine with high pressure over the interior regions of the western United States (known as the Great Basin High) to produce extended periods of light winds and low-level temperature inversions. This condition frequently produces poor atmospheric mixing that results in degraded regional air quality. O_3 standards traditionally are exceeded when this condition occurs during the warmer months of the year.

8.3.2 Regional Air Quality

BAAQMD monitors air pollutant levels continuously throughout the nine-county San Francisco Bay Area Air Basin. The air pollutants of greatest concern in the South Bay Area are ground-level O_3 and PM_{10} because the San Francisco Bay region as a whole does not comply with air quality standards for either pollutant.

Prior to 1995, the San Francisco Bay Area Air Basin was classified by EPA as a "moderate nonattainment" area for O_3 since some air pollutant monitors in the area routinely measure concentrations exceeding the national 1-hour O_3 standard. In 1993, after 3 years of monitoring compliance with the 1-hour O_3 standard, the Bay Area Air Quality Management District (BAAQMD) submitted the 1993 Ozone Maintenance Plan to EPA to request the redesignation of the region to an O_3 maintenance area. The plan included measures to maintain the attainment of the O_3 NAAQS.

In 1995, EPA granted the request and classified the Bay Area as a "maintenance" area after the region had not violated the O_3 standard for 5 years (1990-1994). However, violations of the national 1-hour O_3 standard occurred during the summers of 1995 and 1996. As a result, in 1997 EPA revoked the region's clean air status and designated the area as an "unclassified nonattainment" area for O_3.

In response to the redesignation of the area to an O_3 nonattainment area, the Bay Area co-lead agencies (BAAQMD, MTC, and ABAG) prepared and submitted the San Francisco Bay Area Ozone Attainment Plan, or Ozone SIP, to the California Air Resources Board (CARB). This plan, which was a revision to the 1993 Ozone Maintenance Plan, was submitted to EPA in 1999. The plan includes a compilation of existing and proposed plans and regulations that govern how the region complies with the federal CAA requirements. This plan was designed to show how the region would attain the federal O_3 standard by the end of the 2000 O_3 season (summer) and thereafter.

EPA defines attainment of the national 1-hour O_3 standard as when the Bay Area does not record an exceedance of the O_3 standard more than three times in one year for three consecutive years. The Bay Area continued to violate the O_3 NAAQS in 1998; therefore, attainment of the standard was not possible before 2000. In March 2001, EPA formally announced that the region had not attained the 1-hour O_3 standard and it would only partially approve the plan. As a result, a new Ozone Attainment Plan was developed and submitted to CARB and EPA. This plan is required to demonstrate attainment of the 1-hour O_3 standard by 2006. The BAAQMD, in cooperation with the Metropolitan Transportation Commission and ABAG, prepared the Bay Area 2005 Ozone Strategy Plan, which is replacing the 2001 Ozone Attainment Plan. The 2005 Ozone Strategy Plan addresses national and state air quality planning requirements.

The Bay Area 2001 Ozone Attainment Plan for the national 1-hour O_3 standard included two commitments for further planning: (1) a commitment to conduct a mid-course review of progress toward attaining the national 1-hour O_3 standard by December 2003 and (2) a commitment to provide a revised O_3 attainment strategy to EPA by April 2004 (BAAQMD 2004).

In April 2004, EPA made a final finding that the Bay Area had attained the national 1-hour O_3 standard. The EPA later transitioned from the national 1-hour standard to a new 8-hour standard, as the new standard was considered a more health protective standard. The 8-hour standard took effect in June 2004 and the 1-hour standard was revoked on June 15, 2005.

In May 27, 2008, EPA implemented a more stringent national 8-hour standard of 0.075 ppm. In April 30, 2012, the EPA designated the Bay Area being in nonattainment of the 2008 ozone 8-hour standard.

In 2010, the EPA established new 1-hour standards for sulfur dioxide and nitrogen dioxide. The 1-hour standard for SO_2 is 0.075 ppm. The Bay Area is considered to be in attainment of the new 1-hour national standard for SO_2. For nitrogen dioxide, the 1-hour national standard is 0.100 ppm. The Bay Area is unclassified for the 1-hour national standard for NO_2.

As described above, the San Francisco Bay Area annually exceeds the CAAQS for 1-hour O_3 and 24-hour average PM levels. Throughout the Bay Area, the new 8-hour O_3 standard was exceeded from 3 to 8 days annually from 2009 to 2013. The number of days on an annual basis that exceeded the more stringent 1-hour state O_3 standard at one or more stations in the Bay Area ranged from 3 to 11 days per year during the 5 years, 2009 to 2013 (BAAQMD 2014b). NAAQS for PM_{10} is not exceeded anywhere in the Bay Area, but the more stringent state standard is routinely exceeded in the Bay Area, as well as most other parts of the state. The Bay Area is in nonattainment for the NAAQS for $PM_{2.5}$ for the national 24-hour standard of 35 $\mu g/m^3$ and is also in nonattainment for the state's annual mean standard of 12 $\mu g/m^3$. No other air quality standards are exceeded in the Bay Area. As a result, the San Francisco Bay Area is considered nonattainment for ground-level O_3 at both the state and federal levels, and nonattainment for PM_{10} at the state level only. The Bay Area currently complies with state and federal standards for CO, SO_2, and Pb. For NO_2, the Bay Area is in attainment with the state standards and the national 24-hour standard, but is unclassified for the national 1-hour standard.

8.4 Existing Site Conditions

8.4.1 Air Quality at ARC

Air quality at ARC is best characterized based on local air monitoring data from within BAAQMD's air toxics monitoring network. The Mountain View monitoring station, which is closest to ARC, only measures ground-level O_3 concentrations. The nearest multi-pollutant monitoring stations are in Cupertino and San Jose, several miles to the south.

A summary of air quality monitoring data near ARC is shown in Table 8-2. The values in the table are the highest air pollutant levels measured at these stations over the past 4 years (2010-2013). The new 8-hour standard concentrations exceeding NAAQS or CAAQS are given in Table 8-3. State O_3 and PM_{10} standards were exceeded on several days each year. There were no local exceedances of CO, NO_2, or SO_2.

Table 8-2. Air Pollutant Concentrations near Ames Research Center

Pollutant	Standard	Station Location	2010	2011	2012	2013
PM_{10} (µg/m³)	24 hour	San Jose	47	44	60	58
		Cupertino	27.9	29	42	34
PM_{10} (µg/m³)	Annual	San Jose	19.5	19.4	18.8	22.3
		Cupertino	10.3	14.2	13.5	14.6
CO (ppm)	8 hour	San Jose	2.2	2.3	1.9	2.5
		Cupertino	0.93	1.0	0.8	1.3
O_3 (ppm)	1 hour	San Jose	0.126	0.098	0.101	0.093
		Cupertino	0.127	0.086	0.083	0.091
O_3 (ppm)	8 hour	San Jose	0.086	0.067	0.062	0.079
		Cupertino	0.092	0.067	0.066	.077
		San Jose	0.064	0.061	0.067	0.059
NO_2 (ppm)	1 hour	Cupertino	0.049	0.042	0.045	0.042
		San Jose	0.014	0.015	0.013	0.015
NO_2 (ppm)	Annual	Cupertino	-	0.009	0.008	0.009
		Cupertino	-	0.009	0.008	0.009
Source: BAAQMD 2014c.						

Table 8-3. Summary of Local Air Quality Exceedances

Pollutant	Standard	Station Location	2010	2011	2012	2013
O_3	NAAQS					
	8 hour	San Jose	3	0	0	1
	(0.75 ppm)	Cupertino	-	0	0	1
		Bay Area	9	4	4	3
O_3	CAAQS					
	1 hour	San Jose	5	1	1	0
	(0.09 ppm)	Cupertino	-	0	0	0

Pollutant	Standard	Station Location	2010	2011	2012	2013
		Bay Area	8	5	3	3
PM_{10}	NAAQS	San Jose	0	0	0	0
	24 hour	Cupertino	-	0	0	0
	(150 µg/m3)	Bay Area	0	0	0	0
PM_{10}	CAAQS	San Jose	0	0	1	5
	24 hour	Cupertino	-	0	0	0
	(50 µg/m3)	Bay Area	2	3	2	6
NO_2	NAAQS	San Jose	0	0	0	0
	1 hour	Cupertino	0	0	0	0
	(100 ppm)	Bay Area	0	0	1	0
Other (CO, NO_2, SO_2)	All other	San Jose	0	0	0	0
		Cupertino	0	0	0	0
		Bay Area	0	0	0	0
Source: BAAQMD 2014c.						

8.4.2 Air Pollution Sources

8.4.2.1 *Major Sources of Pollution*

Major pollution sources at ARC include the following:

- External Combustion Sources: All natural gas fired external combustion sources including all permitted and unpermitted boilers, heaters, and other external combustion devices.
- Internal Combustion Sources: All internal combustion equipment (piston engines and turbines) fired by any fuel.
- Evaporative Loss Sources: All solvent use and coating operations.
- Miscellaneous Sources: All NOx sources that do not fit into any of the previous two categories.

Because ARC has a potential to emit NO_x, CO, and CO_2E emissions in excess of the Major Source thresholds, it has accepted voluntary restrictions on its operating parameters to ensure that emissions of these pollutants do not exceed 100 tons per year of criteria pollutant emissions or 90,000 tons/year of CO_2E emissions. This makes the ARC a synthetic minor source, subject to limits that keep emissions below major source thresholds. As such, ARC holds a SMOP under application number 23438 and site number A0550.

The Center's SMOP limits both emissions from individual air pollution sources and facility-wide emissions. Table 8-4 shows the Center's estimated potential air pollutant emissions for calendar year (CY) 2010 and the facility-wide permit emissions limits from the current air permit. Table 8-5 lists the major sources of air pollution at ARC.

Table 8-4. Summary of ARC Potential Emission Rates in 2010

Tons/Year	NOx	CO	PM	SO_x	POC	CO_2E
Combustion Sources						
Permitted Boilers, heaters	49	5	0.43	17	21	147,251
Boilers heaters 2 - 10 MMBTUs	48	40	4	0	5	57,535
Boilers, heaters <2 MMBTUs	17	11	1	0	2	20,964
Total, Combustion Sources	114	56	5	17	28	225,750
Permitted Generators	75	147	3	1	6	6,200
Unpermitted Generators	6	58	0	0	2	58,448
Total, Generators	81	205	3	1	8	64,648
Evaporative Loss Sources						
Permitted sources	0	0	0	0	18	0
Miscellaneous Sources						
Permitted Sources	5.2	0	0.1	0	0.0125	0
Total Potential to Emit	200	261	8	18	54	290,398
Major Source Thresholds	100	100	100	100	100	100,000

Notes:
MMBTUs = Million British Thermal Units
Source: Integrated Science Solutions, Inc. 2011.

Table 8-5. Major Air Pollution Sources at ARC

Source	Location	Pollutants	Control
Boiler – Arc Jet	N234	NO_x, CO, PM, SO_2, TOC, CO_2, CH_4, N_2O, GHG	Low NOx Burner
Boiler – Other	Multiple	NO_x, CO, PM, SO_2, TOC, CO_2, CH_4, N_2O, GHG	None
Diesel powered equipment (generators, water pumps, compressors, etc.)	Multiple. Emergency, Low-use and Prime	NOx, CO, PM, SO_2, TOC, CO_2, CH_4, N_2O, GHG	None for Emergency and Low-use, Diesel Particulate Filters for Prime
Gasoline powered equipment	Multiple	NO_x, CO, PM, SO_2, TOC, CO_2, CH_4, N_2O, GHG	None
Arc Jet Heating Facilities	N234, N238	NO_x	2-stage scrubber
Ethylene oxide sterilizer	N240	NO_x	None
Solvent wipe cleaning	Multiple	TOC	Best management practices
Coating booths	Multiple	TOC	HEPA filters
Laser seeding	Multiple	TOC	None
Fuel dispensing - gasoline	Multiple	TOC	Vapor recovery systems
Oil-water separator	Multiple	TOC	None
Air sparge	W of NFAC	TOC	Carbon packed columns

Notes:
Total organic carbon = TOC
Methane = CH_4
Nitrous oxide = N_2O
Source: Integrated Science Solutions, Inc. 2011.

8.4.2.2 *Indoor Air Vapor Intrusion*

8.4.2.2.1 Background

The Naval Air Station (NAS) Moffett Field is a National Priorities List (NPL) site (EPA ID: CA2170090078) and part of the MEW Superfund Study Area which includes three separately listed NPL sites, including portions of the NAS Moffett Field NPL site.

Groundwater at the Middlefield-Ellis-Whisman (MEW) Superfund Study Area (MEW Site) has been contaminated with VOCs, primarily the solvent trichloroethene (TCE) (Figure 8-1). Portions of that groundwater have migrated northward through the subsurface onto former NAS Moffett Field where the contamination has mixed with U.S. Navy and NASA contaminant sources. The combined area of contamination is referred to as the "regional groundwater contamination plume." Clean up of contaminated groundwater and soil associated with these sources is governed by the Fairchild, Intel, and Raytheon Sites, MEW Study Area, Mountain View, California, 1989 ROD (EPA 1989). For more details on the regional groundwater contamination plume, see Chapter 18, *Hazardous Material*s.

Based on the EPA's updated understanding of the way chemicals can potentially migrate from the subsurface soil and groundwater to the indoor air, EPA requested the Potentially Responsible Parties (PRPs) for the MEW groundwater contamination – the MEW Companies, U.S. Navy, and NASA - to evaluate the potential vapor intrusion pathway into buildings overlying shallow TCE groundwater contamination at the MEW Site. From 2003 through 2008, the MEW Companies, NASA, U.S. Navy, and EPA collected over 3,000 air samples from 47 commercial buildings and 20 residences within the Vapor Intrusion Study Area.

In August 2010, the EPA amended the original 1989 MEW Site ROD, in accordance with CERCLA and the National Contingency Plan (NCP), to address health risks associated with long-term exposure to TCE and other MEW Site Chemicals of Concern (COCs) through the vapor intrusion (VI) pathway in current and future buildings overlying the MEW Site and to select a remedy to prevent exposure to levels exceeding the indoor air cleanup criteria for long-term exposure for residential and commercial buildings (EPA 2010). Human exposure to COCs via the VI pathway occurs when vapors of volatile chemicals in the groundwater and soil enter the building from below and accumulate in indoor air that is subsequently breathed.

EPA's supplemental remedial investigation for the vapor intrusion pathway in the Vapor Intrusion Study Area, including portions of ARC, indicates that there are no immediate or short-term health concerns. All indoor air concentrations were below the screening criteria for acute and short-term health-based Minimal Risk Levels developed by the Agency for Toxic Substances Disease Registry. Therefore, EPA's focus is whether TCE and other Site chemicals of potential concern in indoor air pose an unacceptable risk of chronic health effects from long-term exposure (30 years for residential exposure and 25 years for non-residential exposure).

Under CERCLA, the EPA is the lead regulatory agency responsible for directing the cleanup process for the MEW Site. At ARC, the Navy is the lead agency for the cleanup at NAS

Moffett Field and the San Francisco Bay Regional Water Quality Control Board is the support regulatory agency.

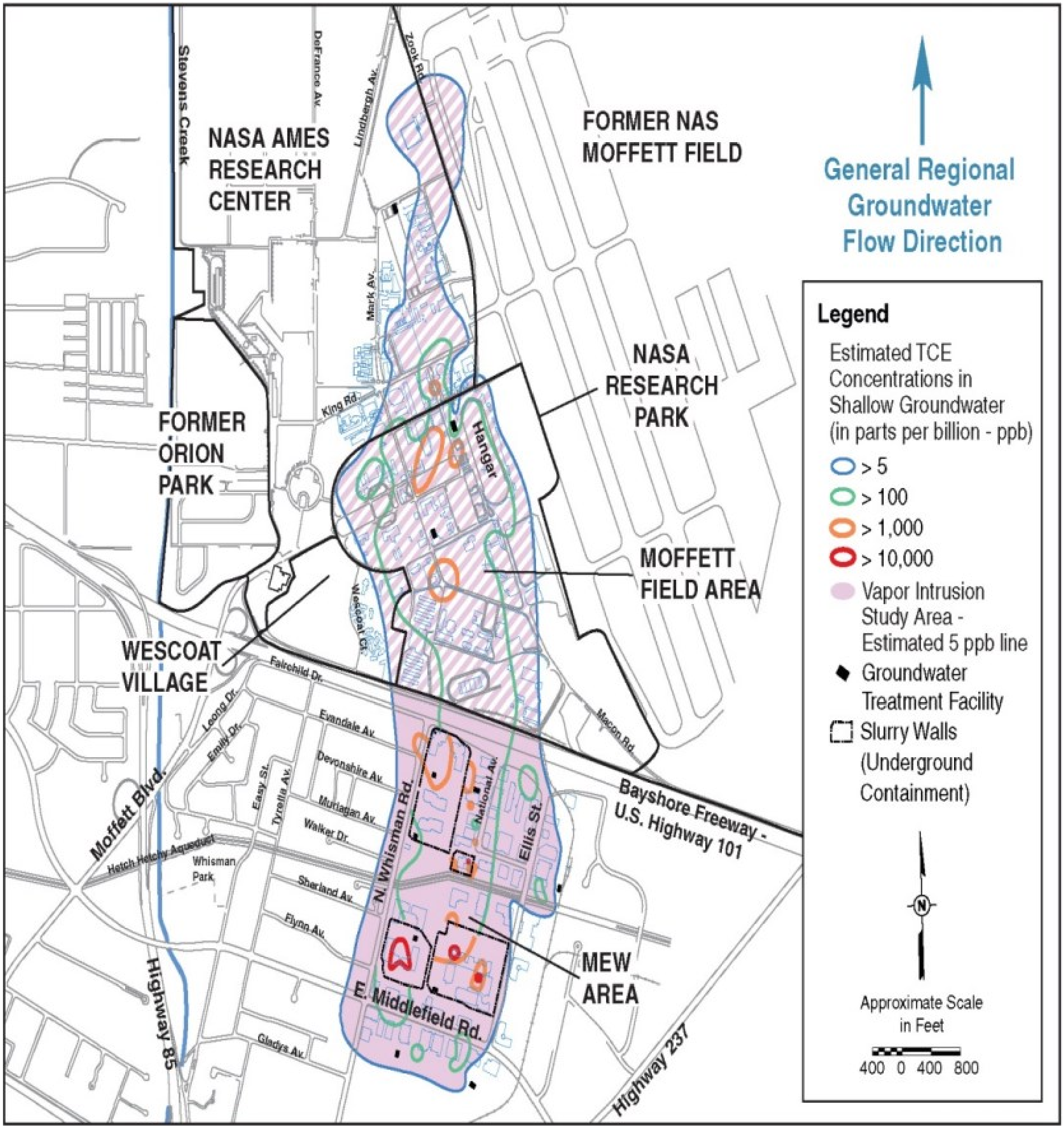

Figure 8-1. Regional Groundwater Contamination Plume

(Source: USEPA 2010)

8.4.2.2.2 Protective Measures for Human Health

Based on the results of groundwater and air sampling results collected since 2002 for both commercial and residential areas (Table 8-6), TCE is the primary chemical of concern for the vapor intrusion pathway along with perchloroethene (PCE), cis- and trans-1,2-dichloroethene (DCE), C_2H_3Cl, 1,1- dichloroethane (DCA), and 1,1-DCE.

Table 8-6. Maximum Concentrations Detected in Shallow Groundwater and Indoor Air – Commercial Area

	MEW Area		Moffett Field Area		
Chemical	**Maximum Groundwater Concentration (µg/L)**	**Maximum Indoor Air Concentration (µg/m³)**	**Maximum Groundwater Concentration (µg/L)**	**Maximum Indoor Air Concentration (µg/m³)**	**Indoor Air Screening Level (µg/m3)**
TCE	40,000	**490**	3,600	**176**	5
PCE	2,500	**8.9**	1,300	**35**	2
cis-1,2-DCE	120,000	190	160,000	17	210
trans-1,2-DCE	2,200	4.8	780	0.9	210
Vinyl Chloride	37,000	**14**	6,700	1.6	2
1,1-DCA	3,000	4.7	340	1	6
1,1-DCE	610	5.2	1,600	0.6	700
Chloroform	14	**9***	18	NT	0.4
1,2-DCB	11,000	2.9	12	1.8	700
1,1,1-TCA	2,700	33	10	5.6	18,000
Freon 113	1,900	64	81	NT	100,000

Notes:
* Result likely from indoor sources and not subsurface vapor intrusion
Bold indicates concentration exceeds indoor air screening level.
NT = Not tested
µg/L = micrograms per liter
(Source: USEPA 2010)

The EPA's strategy to address the vapor intrusion pathway and ensure protection of human health of building occupants in the Vapor Intrusion Study Area consists of the following:

- For Existing Buildings - The appropriate response action is determined by indoor air sampling and other lines of evidence for each building. If necessary, installation, operation, maintenance, and monitoring of an appropriate Sub-slab/Sub-membrane Ventilation System.
- Alternative for Existing Commercial Buildings - Use of building's Indoor Air Mechanical Ventilation System if the property/building owner agrees to use, operate, and monitor the system to meet remedy performance criteria and the remedial action objectives.
- For Future (New Construction) Buildings – Installation of a Vapor Barrier and Passive Sub-slab Ventilation System (With the Ability to be Made Active).
- Implementation of Institutional Controls (ICs) and Monitoring to Ensure the Long-term Effectiveness of the remedy.

After implementation of the vapor intrusion remedy, hazardous substances will remain onsite above levels that allow for unlimited use and unrestricted exposure, thus necessitating Five-Year Reviews. An evaluation of direct removal of the source materials is being conducted in a separate Supplemental Site-wide Groundwater Feasibility Study. Any modifications to the current groundwater remedy will be addressed in a separate ROD Amendment or Explanation of Significant Differences, as appropriate.

The first and second MEW Site Five-Year Reviews of the soil and groundwater remedy were completed in September 2004 and September 2009. A policy review will continue to be conducted a minimum of every five years to ensure that the Site soil, groundwater, and vapor intrusion remedy is, or will be, protective of human health and the environment.

8.4.2.2.3 Air Quality Sampling and Implementation Responsibilities

Following the 2010 ROD Amendment for Vapor Intrusion, the EPA divided Moffett Field into three areas of responsibility to be addressed by the three PRPs (Figure 8-2). PRPs are required to conduct indoor air investigations, including the evaluation of the potential vapor intrusion pathway into buildings overlying shallow TCE groundwater contamination.

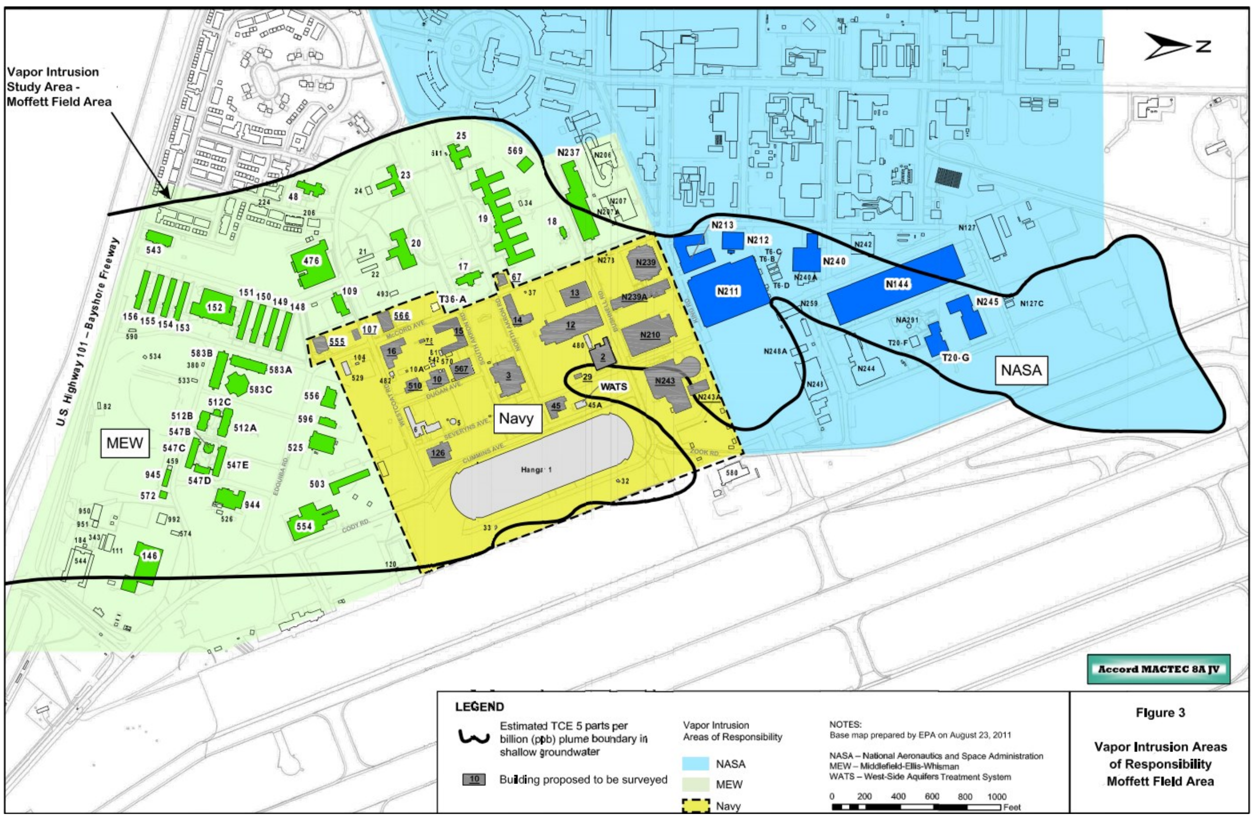

Figure 8-2. Vapor Intrusion Study Area and Areas of Responsibility

(Source: Accord MACTEC 8A JV 2012)

The indoor air vapor intrusion investigations by the PRPs include the following types of samples: indoor air, outdoor ambient air, pathway air, crawlspace air, and sub-slab soil gas. Indoor air samples are to be collected in the breathing zone (approximately 3 to 5 feet above floor level) in occupied or potentially occupied areas. Outdoor ambient air samples are to be collected immediately outside the building, including near the air ventilation system air intake, for comparison to indoor air to evaluate the potential contribution of VOCs from outdoor air to indoor air. Pathway samples are to be collected in areas where potential conduits (such as penetrations through slab, drains, utility lines or vaults) into the building are observed that might provide a direct route for VOC vapor migration into the building. Additionally, background outdoor air samples are to be collected at distances of 0.25 to 1.5 miles away from the Site to assess background levels of VOCs in the general area.

Indoor air results are then compared to (1) short-term health-based screening levels; (2) long-term health-based screening levels, and (3) outdoor ambient air. The EPA uses an interim long-term TCE indoor air screening level of 5.0 $\mu g/m^3$ for commercial buildings and 1 $\mu g/m^3$ for residential buildings.

Vapor intrusion is further assessed by using multiple line of evidence. The types of information to be used include building surveys, chemical use, operations, historical facility and property information, Site geology and hydrogeology, and subsurface and air sampling information and conditions (groundwater, soil gas, sub-slab soil gas, crawlspace, pathway samples), chemical ratios, and tracer compounds, to determine whether the indoor air concentrations are attributable to subsurface Site contamination and no other sources, such as consumer products or outdoor background air sources.

Where discrete mitigation measures (e.g., sealing conduits, enhanced mechanical ventilation, air purifiers, sub-slab vapor control systems) are implemented, indoor TCE concentrations are reduced to below the interim screening level. Increasing air exchange rates generally results in decreasing indoor air TCE concentrations. Vapor intrusion resulting in concentrations above interim long-term indoor air screening levels appears more likely in commercial buildings when ventilation systems are not providing sufficient air exchanges with outside air in all or part of a building.

The EPA has determined that buildings overlying elevated groundwater concentrations appear to have a greater likelihood of indoor air TCE concentrations exceeding the TCE screening level, but that actual indoor air concentrations are also dependent on other building factors such as air ventilation system operations, building configuration, and preferential pathways into the building.

On an ongoing basis, the PRPs conduct indoor air sampling and investigations in accordance with the provisions of the 2010 EPA ROD Amendment for VI. Building surveys are conducted to identify each building's structural condition, observe the ventilation system layout and use by the building occupants, observe operational procedures in laboratory and maintenance areas, and gather information about building use schedules. Prior to conducting the surveys, information on basic HVAC systems and chemical use and storage are collected. Building survey results are used to select potential sampling locations within each building for the indoor air sampling work plan.

The 2010 ROD also provides a tiering system to determine the appropriate response action for each building within the Vapor Intrusion Study Area. The tiering system for existing buildings is based on indoor air sampling with or without engineering controls (ECs) in place, and other lines of evidence.

To determine the appropriate tier and corresponding response action for the nonresidential buildings within each area of responsibility, a vapor intrusion investigation is conducted consisting of indoor air sampling and background air sampling and analysis of COCs by EPA Method TO-15 SIM. Samples are collected in the breathing zone of work areas (office areas, meeting rooms, and high-traffic areas such as hallways), at potential vapor intrusion pathways (foundation cracks, expansion joints, crawl spaces, drains, and pipe inlets), and in ambient outdoor air. Grab samples are collected in elevator shafts (ventilation pathways between floors) with priority given to basement and first-floor work areas, followed by potential pathways, then second- through fourth-floor work areas.

Using the indoor air sampling results, the buildings are tiered to determine the need for a response action in accordance with EPA's Response Action Tiering System, described in detail in the 2010 ROD Amendment. Indoor air quality for COCs is compared to the ROD Amendment cleanup levels and to ambient outdoor air with consideration of whether or not an air quality EC is in place and operating correctly.

The Moffett Field Area is primarily used for military housing, air operations, storage, educational facilities, research and development, office, and retail space. NASA's redevelopment plans in the Moffett Field Area include demolition of all non-historic structures. Plans are underway to redevelop unimproved land at Moffett Field into sustainable research facilities including office, educational, recreational, and residential uses. Cleanup actions are being taken at the Site under the 1989 ROD to restore groundwater to its potential beneficial use, which is designated as drinking water. Note that the groundwater at the Site is not currently being used for drinking water or other domestic purposes.

The alternatives evaluated for the vapor intrusion pathway are:

- Alternative 1: No Action
- Alternative 2: Active Indoor Air Ventilation System, Monitoring, and ICs
- Alternative 3: Passive Sub-slab Ventilation with Vapor Barrier (and Ability to Convert to Active), Monitoring, and ICs
- Alternative 4: Active Sub-slab or Sub-membrane Ventilation, Monitoring, and ICs

ICs are non-engineered legal and administrative instruments that help to minimize the potential for human exposure to contamination and protect the integrity of an engineered remedy. There are four categories of ICs: government controls; proprietary controls; enforcement tools with IC components; and informational devices. Each of these types of ICs can be used, alone or in combination, to ensure the protectiveness of an engineered remedy. See the "Final Supplemental Feasibility Study for the Vapor Intrusion Pathway" (Haley & Aldrich, Inc. 2009) for more detailed information and an evaluation of each of the ICs considered.

For new development at NASA Research Park within the Moffett Field Area, the remedy will rely in part on management procedures already in place by ARC. ARC uses its March 2005 Environmental Issues Management Plan (EIMP) as a decision framework for the management of residual chemicals in soil and groundwater. The EIMP already includes certain measures to be implemented in future development at NASA Research Park to address the vapor intrusion pathway. Specifically, the EIMP provides design requirements for new construction, risk management procedures for future subsurface activities, and procedures for long-term management of environmental conditions in the NASA Research Park area. Specifically with regard to vapor intrusion, the EIMP requires all future construction overlying 5 part per billion (ppb) of VOCs in the shallow groundwater to incorporate vapor intrusion mitigation either with a sub-slab ventilation system or an indoor air mechanical ventilation system that maintains positive pressure. Additionally, after mitigation measures are implemented, the EIMP requires ongoing monitoring of contaminants and remedial measures.

A portion of the Moffett Field Area is not within the NASA Research Park area, but is also owned by NASA. For those properties and all properties within the Moffett Field Area, sampling, operations, maintenance, and monitoring requirements should be, according to the 2010 VI ROD, incorporated into the appropriate Master Plan planning documents. Additionally, similar requirements to those in the EIMP should be adopted for new construction within the Moffett Field Area and for ongoing implementation and monitoring of the remedy.

8.4.3 **Conformity Analysis**

As noted above, Section 176(c) of the CAA Amendments requires federal agencies to ensure that their actions conform to applicable plans for achieving and maintaining the NAAQS. The primary oversight responsibility for assuring conformity is assigned to the federal agency.

Prior to publication of the final NADP EIS, NASA calculated the annual emissions associated with the build out and operations of the NADP to evaluate the need for a conformity analysis. The calculations indicated that the project-related emissions would exceed *de minimis* levels of CO for Alternatives 2 through 5 under 10-year build out plans. Thus, implementation of any of Alternatives, including Mitigated Alternative 5, required a SIP conformity determination for CO.

NASA subsequently drafted a conformity determination, which is included in Appendix D of the NADP EIS. The conformity determination found that the predicted CO concentrations associated with the development of the NADP would not cause or contribute to any new violation of the NAAQS for CO or increase the frequency or severity of any existing violation of the CO NAAQS. As such, NASA determined that implementation of Mitigated Alternative 5 would conform to the applicable SIP for CO.

8.5 **Environmental Requirements**

NASA has identified the following environmental plans, policies, and measures that address potential air quality effects of operations and future development at ARC.

8.5.1 **NASA Procedural Directive 8500.1, NASA Environmental Management**

Per NPD 8500.1, it is NASA policy to: maintain compliance with all applicable federal, state, and local environmental requirements; to incorporate environmental risk reduction and sustainable practices to the extent practicable throughout NASA's programs, projects, and activities; and to consider environmental factors throughout the life cycle of programs, projects, and activities (as defined in NPD 7120.4, *NASA Engineering and Program/Project Management Policy*, and related documents), including planning, development, execution, and disposition activities. Examples of environmental factors include consideration of environmental impacts as required by the NEPA and NHPA; the proposed use of hazardous materials; the potential for waste generation; the need to acquire necessary permits, waivers, and authorizations; and the use of environmentally-preferable materials and processes wherever practicable.

8.5.2 NASA Procedural Requirements 8553.1, NASA Environmental Management System

NPR 8553.1 sets forth requirements for the NASA EMS, which functions primarily to: (1) incorporate people, procedures, and work practices into a formal structure to ensure that the important environmental impacts of the organization are identified and addressed; (2) promote continual improvement, including periodically evaluating environmental performance; (3) involve all members of the organization, as appropriate; and (4) actively involve senior management in support of the EMS.

Agencywide, the EMS employs a standardized approach to managing environmental activities that allows for efficient, prioritized system execution, while at the same time helping to improve environmental performance and to maintain compliance with applicable environmental regulations and requirements. NASA's EMS approach involves identifying all activities, products, and services under each NASA center's control, and the environmental aspects associated with each centers' continued engagement in those activities, products, and services. Once identified, priority environmental aspects are assigned a risk ranking (from 1 to 4, based on its severity and frequency of occurrence) and are evaluated on a continual basis as means of highlighting associated positive or negative impacts and setting objectives and targets to reduce environmental risk. Each center's EMS also identifies methods for ensuring compliance by keeping abreast of environmental requirements. This includes requirements by law (EOs, federal regulations, state and local laws) and voluntary commitments made by the center or NASA.

8.5.3 Ames Procedural Requirements 8500.1, Ames Environmental Procedural Requirements

APR 8500.1 sets forth general procedural requirements to ensure compliance with applicable federal, state, and local environmental laws; regulations and EOs; and NASA policies and procedures. Organizational directors, division chiefs, branch chiefs, section heads, supervisors, managers, and CORs are responsible for planning, designing, constructing, managing, operating, and maintaining facilities in conformance with applicable regulatory directives, and should obtain environmental review from the Environmental Management Division early in project planning consistent with NASA's NEPA implementing procedures (NPR 8580.1 and EO 12114), NASA policies and procedures for programs and projects (NPR 7120), and NASA regulations related to environmental quality (14 CFR 1216). Program and project managers should coordinate with the Environmental Management Division in a timely manner to ensure that any new or modified programs, projects, and activities comply with regulatory requirements.

8.5.4 Ames Procedural Requirements 8553.1, Ames Environmental Management System

APR 8553.1 sets forth requirements for the Center-level EMS in accordance with NPR 8553.1B, *NASA Environmental Management Systems*. The ARC EMS also includes consideration of the findings of NASA Headquarters' triennial (3-year) Environmental Functional Review and other external EMS audits, as required.

Under the ARC EMS, the Center conducts an annual risk analysis across Center activities to determine which of 16 environmental aspects are of high or medium priority. The Center then identifies objectives (goals) and targets and develops action plans known as Environmental Management Plans to reduce identified risks. Currently, the high- and medium-priority environmental aspects of Center business activities are *Air Emissions*, *Hazardous Material Management*, *Water and Energy Conservation*, and *Other Sustainability Practices*. Objectives associated with these high- and medium-priority environmental aspects include:

- Reducing air (including GHG) emissions through energy efficiency
- Improving hazardous material management
- Improving energy and water efficiency
- Providing for the integration of other sustainability practices into Center activities

8.5.5 Ames Environmental Work Instructions

Ames's EWIs, which replace the previous Ames Environmental Handbook (APR 8800.3), set forth requirements to ensure that programs, projects, and activities at ARC comply with applicable federal, state, and local laws; regulations and EOs; and NASA policies and procedures. Each EWI lists relevant regulatory authorities and documents, assigns individual and organizational responsibilities within ARC, and identifies specific requirements applicable to the work being performed.

The following EWIs are relevant to operations and future development at ARC with the potential to impact air quality.

- EWI 1, Air
- EWI 12, Public Involvement
- EWI 14, NEPA and Environmental Justice
- EWI 18, Environmental Requirements for Construction Projects (Under review)

8.5.6 NASA Ames Research Center Environmental Issues Management Plan

ARC's EIMP contains numerous measures designed to be protective of human health due to potential exposure via vapor intrusion including methods to address VOC vapor intrusion into new construction and existing buildings, and reducing the potential for lateral migration of VOCs in utility corridors. Please see the full text of the EIMP for more information.

8.5.7 Construction Emissions Mitigation Plan for NASA Ames Development Plan Projects

As required by NADP EIS Mitigation Measures AQ-7b and AQ-7b (see below), ARC maintains a CEMP to ensure that construction and operations under the NADP can generate no more than 91,000 kilograms (100 tons) each of ozone precursors per year. Additionally, activities under the NADP are constrained by air quality concerns associated with emissions of diesel particular matter, which the State of California lists as a toxic air contaminant based on its potential to increase the risk of cancer, premature death, and other health problems. The CEMP sets forth requirements for tracking anticipated construction, demolition, and new facility operation by NASA and its partners; lists possible emissions reduction strategies if emissions are projected to exceed *de minimis* levels in a given year; includes measure to control fugitive dust and equipment and vehicle emissions; and designates a CEMP/Disturbance Coordinator responsible for ensuring that measures included in the CEMP are implemented. The CEMP also includes an analysis addressing the feasibility of using reformulated or alternative diesel fuel to power contractor construction vehicles and/or equipment, updated biennially, as well as an analysis addressing the feasibility of using low emissions construction equipment, updated annually. As an added requirement, NASA also consults with the BAAQMD on an annual basis during project construction to determine if additional air quality mitigations to reduce the project's air quality impact are warranted.

8.5.8 EPA's 2010 Record of Decision Amendment for the Vapor Intrusion Pathway, Middlefield-Ellis-Whisman Superfund Study Area

The EPA's strategy to address the vapor intrusion pathway and ensure protection of human health of building occupants in the Vapor Intrusion Study Area consists of the following:

- For Existing Buildings - The appropriate response action is determined by indoor air sampling and other lines of evidence for each building. If necessary, installation, operation, maintenance, and monitoring of an appropriate Sub-slab/Sub-membrane Ventilation System.
- Alternative for Existing Commercial Buildings - Use of building's Indoor Air Mechanical Ventilation System if the property/building owner agrees to use, operate, and monitor the system to meet remedy performance criteria and the remedial action objectives.
- For Future (New Construction) Buildings – Installation of a Vapor Barrier and Passive Sub-slab Ventilation System (With the Ability to be Made Active).
- Implementation of ICs and Monitoring to Ensure the Long-term Effectiveness of the remedy.

Responsibility for implementation is determined according to the Areas of Responsibility (see Figure 8-2 of the "Indoor Vapor Intrusion" section in this chapter).

8.5.9 NASA Ames Development Plan Final Programmatic Environmental Impact Statement

The NADP FEIS identifies the following mitigation measures to address potential air quality impacts from build out of NADP Mitigated Alternative 5.

8.5.9.1.1 Mitigation Measure AQ-2

NASA and its partners would schedule construction to ensure that annual emissions of ozone precursors associated with project construction and operation do not exceed a cumulative total of 100 tons per year. This would apply over all years of project construction and operation or until an applicable State Implementation Plan that includes the project emissions is approved by EPA. Implementation of this mitigation is mandatory to comply with the Federal Clean Air Act.

8.5.9.1.2 Mitigation Measure AQ-3

Prior to the issuance of occupancy permits, operators of laboratories and disaster training facilities would be required to consult with the BAAQMD regarding possible permit requirements and emissions reduction equipment and to comply with BAAQMD's requirements.

8.5.9.1.3 Mitigation Measure AQ-4

Long-term residential uses would be avoided at areas located over high concentration zones of the Regional Plume in accordance with the Human Health Risk Assessment (HHRA) and the Environmental Issues Management Plan (EIMP), unless construction mitigation measures are implemented to reduce the risk of vapor intrusion.

8.5.9.1.4 Mitigation Measure AQ-5

NASA would review all planned uses in light of the findings of the HHRA to ensure that planned uses would not create unacceptable public health risks. Proposed uses would be moved if unacceptable risks were found that could not be mitigated to an acceptable level.

8.5.9.1.5 Mitigation Measure AQ-6a

Measures to control dust generation would reduce the impact associated with PM10 to a level of less-than-significant. The following measures, including all control measures recommended by the BAAQMD, would be incorporated into construction contract specifications and enforced by NASA. These measures include the following provisions.

- *Use reclaimed water on all active construction areas at least twice daily and more often during windy periods. Watering is the single* *most effective measure to control dust emissions from construction sites. Proper watering could reduce dust emissions by over 75%.*

- *Cover all hauling trucks or maintain at least 0.6 meters (2 feet) of freeboard. Use dust-proof chutes as appropriate to load debris onto trucks during any demolition.*
- *Pave, apply reclaimed water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites.*
- *Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas and sweep streets daily (with water sweepers) if visible soil material is deposited onto the adjacent roads.*
- *Hydro seed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas that are inactive for 10 days or more).*
- *Enclose, cover, water twice daily, or apply (non-toxic) soil binders to exposed stockpiles.*
- *Limit traffic speeds on any unpaved roads to 25 kilometers per hour (15 mph).*
- *Install sandbags or other erosion control measures to prevent silt runoff to public roadways.*
- *Replant vegetation in disturbed areas as quickly as possible.*
- *Install wheel washers for all exiting trucks, or wash off the tires or tracks of all trucks and equipment leaving the site.*
- *If necessary, install windbreaks, or plant trees/vegetative windbreaks at the windward side(s) of construction areas.*
- *Suspend excavation and grading activity when winds (instantaneous gusts) exceed 40 kilometers per hour (25 mph) and visible dust emission cannot be prevented from leaving the construction site(s).*
- *Limit areas subject to disturbance during excavation, grading, and other construction activity at any one time.*
- *Prior to disturbance (or removal) of materials suspected to contain asbestos, lead, or other toxic air contaminants, contact the BAAQMD.*
- *NASA would designate an Environmental Coordinator responsible for ensuring that mitigation measures to reduce air quality impacts from*

construction are properly implemented. This person would also be responsible for notifying adjacent land uses of construction activities and schedule.

8.5.9.1.6 Mitigation Measure AQ-6b

- *Measures to reduce emissions of nitrogen oxides and particulate matter from diesel fuel combustion during construction should be evaluated and implemented where reasonable and feasible. The following measures would reduce the impacts from construction fuel combustion.*
- *Properly maintain construction equipment. This measure would reduce emissions of ROG, NOx, and PM10 by about 5%.*
- *Evaluate the use of available alternative diesel fuels and, where reasonable and feasible, use alternative diesel fuels. The CARB has verified reductions of NOx by almost 15%, and particulate matter by almost 63%, from use of alternative diesel fuels. However, the use of these fuels may not be appropriate for all diesel equipment.*
- *Reduce construction traffic trips through Transportation Demand Management (TDM) policies and implementation measures.*
- *Reduce unnecessary idling of construction equipment and avoid staging equipment near or upwind from sensitive receptors such as on-site residences or daycare uses.*

Where possible, use newer, cleaner burning diesel-fueled construction equipment. The Environmental Coordinator would prohibit the use of equipment that visibly produces substantially higher emissions than other typical equipment of similar size.

8.5.9.1.7 Mitigation Measure AQ-7a

NASA would install air pollution devices, for example, particulate traps and oxidation catalysts, on construction equipment to the greatest extent that is technically feasible.

8.5.9.1.8 Mitigation Measure AQ-7b

NASA and its partners would develop and implement a Construction Emissions Mitigation Plan (CEMP) to ensure that the project would comply with the Federal Clean Air Act and further reduce emissions. The plan would include measures and procedures, sufficiently defined to ensure a reduction of nitrogen oxides, PM10, and diesel particulate matter. The CEMP would be developed in consultation with EPA and BAAQMD. The CEMP would be evaluated by NASA and its partners on an annual basis to schedule *construction ensuring that emissions of ozone precursors associated with project construction and operation would not exceed 91 tonnes (100 tons) per year and update measures to include new rules or regulations. NASA and its partners would consult with the BAAQMD on an annual basis during project construction to determine if additional air quality mitigations to reduce the project's air quality impact are warranted, and to take such additional air quality mitigation as is appropriate and reasonable, and in an expeditious manner. A CEMP coordinator, who would also act as a "Disturbance Coordinator," would be responsible for ensuring that measures included in the CEMP are implemented. This would be done through field inspections, records review, and investigations of complaints. At a minimum, the CEMP would include the following measures to reduce emissions from construction activities:*

- *Require that all equipment be properly maintained at all times.*
- *All construction equipment working on site would be required to include maintenance records indicating that all equipment is tuned to engine manufacturer's specifications in accordance with the time frame recommended by the manufacturer. All construction equipment would be prohibited from idling more than 5 minutes.*
- *Tampering with equipment to increase horsepower would be strictly prohibited.*
- *Include particulate traps, oxidation catalysts, and other suitable control devices on all construction equipment used at the site.*
- *Diesel fuel having a sulfur content of 15 ppm or less, or other suitable alternative diesel fuel, would be used unless such fuel cannot be reasonably procured in the market area.*
- *The CEMP would also ensure that construction-related trips are minimized through appropriate policies and implementation measures.*
- *The CEMP would address the feasibility on a biannual basis of requiring the use of reformulated or alternative diesel fuels.*
- *The CEMP Coordinator (or Environmental Coordinator) would prohibit the use of equipment that visibly produces substantially higher emissions than other typical equipment of similar size. The staging of three or more pieces of construction equipment near or just upwind from sensitive receptors such as residences or daycare uses would be prohibited.*

8.5.9.1.9 Mitigation Measure AQ-7c

The CEMP would address the feasibility of requiring or encouraging the use of "cleaner" (lower emissions) construction equipment on an annual basis. For larger construction projects (projects greater than 9,290 square meters (100,000 square feet)), a percentage of the equipment would be required to be 1996 or newer. This would be determined as follows:

- *If equipment is leased by the Contractor, then the percentage of 1996 or newer equipment would be maximized so that the total cost of leasing equipment would not exceed 110% of the average available cost for leased equipment.*
- *If equipment is owned by the Contractor, then the CEMP shall identify the minimum percentage of total horsepower for 1996 or newer equipment that should be used in construction. For the first year of construction, it shall be considered possible that 1996 or newer equipment shall makeup a minimum of 75% of the total horsepower, unless NASA and its partners can show the BAAQMD that it is not reasonable.*