Chapter 19. Hazardous Materials and Site Contamination

19.1 Overview

This chapter describes the use and management of chemical, radioactive and other materials broadly categorized as hazardous materials[20]. Applicable regulations and NASA's pollution prevention practices are also discussed. Information regarding hazardous materials was obtained from the November 2009 NASA ARC ERD (NASA 2009), NAPD EIS (Design, Community & Environment 2002), internal documents, and other sources.

19.2 Regulatory Background

19.2.1 Federal Regulations

19.2.1.1 *Resource Conservation and Recovery Act*

The Resource Conservation and Recovery Act (RCRA), including the Federal Hazardous and Solid Waste Amendments, is the primary law governing disposal of solid and hazardous waste. RCRA established three distinct, yet interrelated, programs:

- The solid waste program, under RCRA Subtitle D, which encourages states to develop comprehensive plans to manage nonhazardous industrial solid waste and municipal solid waste, sets criteria for municipal solid waste landfills and other solid waste disposal facilities, and prohibits the open dumping of solid waste.
- The hazardous waste program, under RCRA Subtitle C, which establishes a system for controlling hazardous waste from the time it is generated until its ultimate disposal.
- The underground storage tank (UST) program, under RCRA Subtitle I, which regulates underground storage tanks containing hazardous substances and petroleum products.

RCRA focuses only on active and future facilities and does not address abandoned or historical sites, which are managed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

19.2.1.2 *Comprehensive Environmental Response, Compensation, and Liability Act*

CERCLA, commonly known as Superfund, was enacted by Congress in 1980. This law created a tax on the chemical and petroleum industries and provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA:

[20] Hazardous materials, as defined by the California Department of Toxic Substances Control (DTSC), are any materials that, because of their quantity, concentration, physical, or chemical characteristics, pose a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. Extremely or acutely hazardous materials are materials that may cause rapid death, permanent injury, or persistent harm to the environment.

- Established prohibitions and requirements concerning closed and abandoned hazardous waste sites;
- Provided for liability of entities responsible for releases of hazardous waste at these sites; and
- Established a trust fund to provide for cleanup when no responsible party could be identified.

CERCLA authorizes two kinds of response actions:

- Short-term removals, where actions may be taken to address releases or threatened releases requiring prompt response, and
- Long-term remedial response actions that permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances that are serious, but not immediately life threatening. These actions can be conducted only at sites listed on EPA's National Priorities List (NPL).

CERCLA also enabled revision of the National Contingency Plan (NCP), which provides the guidelines and procedures for responding to releases and threatened releases of hazardous substances, pollutants or contaminants. The NCP also established the NPL. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986.

19.2.1.3 *Toxic Substances Control Act*

PCBs are regulated under the Emergency Planning and Community Right-to-Know Act (EPCRA) (40 CFR 350-372); PCB Manufacturing, Processing, Distribution in Commerce and Use Prohibitions (40 CFR 761); Toxic Substances Control Act (PL-94-469); and EOs (12088, 12580, and 12856).

19.2.1.4 *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.

19.2.2 State Regulations

California regulations are equal to or more stringent than federal regulations. EPA has granted the State primary oversight responsibility to administer and enforce hazardous waste management programs. State regulations require planning and management to ensure that hazardous wastes are handled, stored, and disposed of properly to reduce risks to human health and the environment. State regulatory requirements are found in the California Health and Safety Code, and CCR, Titles 22 and 26. California's hazardous materials regulations include the California Hazardous Waste Requirements (22 CCR 66261–66268, 67426–66429, and 67780).

19.2.2.1 *Hazardous Materials Release Response Plans and Inventory Act of 1985*

The Hazardous Materials Release Response Plans and Inventory Act, also known as the Business Plan Act, requires businesses using hazardous materials to prepare a hazardous materials business plan that describes their facilities, inventories, emergency response plans, and training programs. *Hazardous materials* are defined as raw or unused materials that are part of a process or manufacturing step. They are not considered hazardous waste. Health concerns pertaining to the release of hazardous materials, however, are similar to those relating to hazardous waste.

19.2.2.2 *Hazardous Waste Control Act*

The Hazardous Waste Control Act created the state hazardous waste management program, which is similar to, but more stringent than, the federal Resource Conservation and Recovery Act program. The act is implemented by regulations contained in 26 CCR, which describes the following required aspects for the proper management of hazardous waste:

- Identification and classification
- Generation and transport
- Design and permitting of recycling, treatment, storage, and disposal facilities
- Treatment standards
- Operation of facilities and staff training
- Closure of facilities and liability requirements

These regulations list more than 800 materials that may be hazardous and establish criteria for their identification, packaging, and disposal. Under the Hazardous Waste Control Act and 26 CCR, the generator of hazardous waste must complete a manifest that accompanies the waste from the generator to the transporter to the ultimate disposal location. Copies of the manifest must be filed with the DTSC.

19.2.2.3 *Emergency Services Act*

Under the Emergency Services Act, the state developed an emergency response plan to coordinate emergency services provided by federal, state, and local agencies. Rapid response to incidents involving hazardous materials or hazardous waste is an important part of the plan, which is administered by the California Office of Emergency Services. The office coordinates the responses of other agencies, including the EPA, California Highway Patrol, RWQCBs, air quality management districts, and county disaster response offices.

19.2.2.4 *California Occupational Safety and Health Administration Standards*

Workers potentially exposed to hazardous material, hazardous waste or contaminated media are subject to monitoring and personal safety equipment requirements established in California Occupational Safety and Health Administration (Cal/OSHA) regulations (Title 8).Title 8 specifically addresses airborne contaminants and controls pertaining to asbestos and lead exposure during construction activities. The primary intent of the Title 8

requirements is to protect workers, but compliance with some of these regulations would also reduce potential hazards to non-construction workers and project area occupants because required site monitoring, reporting and other controls would be in place.

Workers who are in direct contact with soil or groundwater containing hazardous levels of constituents would perform all activities in accordance with a hazardous operations site-specific health and safety plan (HSP), as outlined in Cal/OSHA standards. An HSP is not required for workers such as heavy equipment operators, carpenters, painters, or other construction workers who would not be performing investigation or remediation activities where direct contact with materials containing hazardous levels of constituents could occur. However, elements of an HSP protect those workers who may be adjacent to cleanup activities by establishing engineering controls, monitoring, and security measures to prevent unauthorized entry to cleanup sites and to reduce hazards outside the investigation/cleanup area.

In addition to an HSP, Cal/OSHA requires that sites on the NPL must have a risk management plan (RMP) that is reviewed and approved by the RWQCB and administered by the responsible party. The RMP identifies specific measures to reduce potential risks to human and ecological populations during construction of the proposed project for each site or group of sites to be developed. The RWQCB follows EPA guidelines for risk management.

EPA, RWQCB, and DTSC guidelines define potential health risks associated with chemical exposure as excess lifetime cancer risk and non-cancer toxicity. Excess lifetime cancer risk is estimated from exposure concentrations, exposure duration and risk/potency factors. The calculated cancer risk approximates the probability of an individual developing cancer over the course of a lifetime due to exposure to a cumulative dose of a potential carcinogen.

Unlike cancer risk estimates, the measure used to describe the potential for non-carcinogenic toxic effects to occur is expressed in terms of a hazard index (HI), which is calculated as the ratio of the predicted acute or chronic exposure (dose) of a non-carcinogenic substance to that chemical's toxicity threshold, often referred to as the reference dose. The HI assumes that there is a level of exposure below which it is unlikely, even for sensitive populations, to experience adverse health effects. Because there are inherent uncertainties and assumptions used in the modeling, the final calculated risk values are viewed as conservative estimates of exposure risk.

19.2.3 **Local Regulations**

The Santa Clara County Department of Environmental Health regulates hazardous material storage and use at ARC. The regulatory requirements are specified in the Hazardous Materials Storage Ordinance (County of Santa Clara, March 17, 2003) and the Toxic Gas Storage Ordinance (County of Santa Clara).

All hazardous material storage areas are permitted by the County of Santa Clara based on the individual facility, the maximum quantity of the material stored, and by its hazard class. Typical hazard classes found at ARC are compressed gases, flammable liquids and solids, oxidizers, organic peroxides, poisons, corrosives, and other regulated materials. The permits are compared with current inventories annually to ensure that the appropriate permits are maintained for each facility at ARC.

19.2.4 Other Laws, Regulations, and Programs

Various laws, regulations, EOs, and other requirements are applicable to hazardous materials management, including:

- Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65), which requires labeling of substances known or suspected by the State of California to cause cancer
- California Government Code Section 65962.5, which requires the Office of Permit Assistance to compile a list of possible contaminated sites in the State of California
- Comprehensive Environmental Response, Compensation, and Liability Information System
- National Priorities List for Uncontrolled Hazardous Waste Sites
- Emergency Planning and Community-Right-to-Know Act of 1986 (Public Law 99-499)
- Superfund Amendments and Reauthorization Act, Title III, Sections 312 and 313
- Pollution Prevention Act of 1990 (42 USC 13101 et seq.)
- Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984 (42 USC 6002)
- Presidential Executive Order 12969, Federal Acquisition and Community Right-To-Know Presidential Executive Order 13423 Strengthening Federal Environmental, Energy, and Transportation Management
- Presidential Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance
- Hazardous Waste Source Reduction and Management Review Act of 1989 (Senate Bill 14), CCR Title 22, Sections 67100.4, 67100.5
- NASA Procedural Requirements 8530.1A Affirmative Procurement Program and Plan for Environmentally Preferable Products.

19.3 Regional Setting

A plume of contaminated groundwater flows northward beneath ARC toward the San Francisco Bay. At present, the plume underlies a total of 130 hectares (320 acres) of ARC, most of which is within the NRP area. The main contaminants in the plume are volatile organic compounds (VOCs), among them TCE, 1,1,1-TCE, cis- and trans- 1,2 DCE, 1,1-DCE, 1,1-DCE, dichlorobenzene, chloroform, Freon 113, phenol, and C_2H_3Cl. The first two are the most commonly found.

The Regional Plume stems from two main sources: an EPA-designated Superfund site outside of ARC at the MEW site across U.S. Highway 101, and contamination from operations at Moffett Field during the Navy's administration of the base.

Another solvent-contaminated groundwater plume exists in the former Orion Park military housing area immediately adjacent to ARC and has migrated onto the west portion of ARC. The regulatory agencies have not identified the responsible parties for the plume. ARC is voluntarily operating an air sparging and soil vapor extraction system located on the western ARC boundary to mitigate this plume (see Figure 19-1, *Extent of Regional Plume and Orion Park Plume*).

19.4 Existing Site Conditions

ARC's core businesses are astrobiology, nanotechnology, information technology, aviation systems, airspace operations, research and development, and related support operations. Resident agencies conduct a variety of activities, including research and development, airfield operations, administrative, and military support operations. As such, routine operations require the use of numerous types and quantities of hazardous materials, resulting in the generation of hazardous and nonhazardous wastes at ARC.

ARC, including tenants and resident agencies, uses a wide variety of hazardous materials for research and operations. At any given time, there may be more than 5,000 hazardous substances in the laboratories, shops, and other facilities within the Ames Campus area, producing a comparable number of types of hazardous waste. The quantities from laboratories are often small: ounces or grams of particular substances; quantities from shops and other operations may be greater than 55 gallons.

Both ARC, tenants, and resident agencies are responsible for regulatory compliance at the site. Tenant and resident agency organizations are responsible for obtaining hazardous materials permits required for their operations and preparing emergency response plans and procedures. These organizations are required to comply with the same regulations as ARC. The PCB and radiation safety programs are managed collectively over the entire ARC site.

In addition, NASA is dedicated to sustaining an effective environmental protection culture. A significant aspect of that culture is pollution prevention. NASA's pollution prevention strategy is to eliminate or reduce the use of hazardous substances, to reuse or recycle hazardous materials, to dispose of hazardous materials and hazardous waste in an environmentally safe manner, to buy recycled products, and to recycle.

19.4.1 Restoration Sites

Hazardous materials consisting of solvents, metals, PCBs and petroleum products have been released to the environment on Former NAS Moffett Field and ARC (Site) from operations conducted by the US Navy and NASA. In addition, groundwater contaminated with solvents (MEW Regional Plume) has migrated onto NAS Moffett Field and ARC. The sources of this contaminated groundwater are responsible parties (MEW Companies) located south of NAS Moffett Field. A second solvent-contaminated groundwater plume is located immediately west of ARC and has migrated onto ARC. The responsible parties for the western plume have not been identified by the EPA or the State.

The NAS Moffett Field Superfund site was listed on the NPL in July 1987 (52 Fed. Reg. 27620), and the Navy has been addressing contamination pursuant to the Navy's 1990

Moffett Federal Facility Agreement (FFA), as amended in 1994. The 1990 FFA requires the Navy to conduct remedial investigations and feasibility studies, conduct removal actions, and select and implement remedial actions to protect human health and the environment at NAS Moffett Field. Similarly, the MEW Companies have been addressing contamination from the MEW Superfund Site that reaches onto the Moffett Field pursuant to the 1991 Unilateral Administrative Order (UAO) and 1992 Consent Decree (CD), both as amended.

In 1994, a majority portion of NAS Moffett Field, with the exception of the Wescoat, Orion Park, and Shenandoah housing, is subject to a MOU that established roles for conduct of environmental restoration and ongoing environmental compliance at NAS Moffett Field.

As the current land owner of NAS Moffett Field, NASA has a combined role at the Site. NASA must address its own sources of contamination while also implementing Land Use Controls (LUCs) that ensure the protectiveness of other parties' response actions at the Site, including the CERCLA response actions at NAS Moffett Field being conducted by Navy and by the MEW Companies.

In the early 1990s, ARC implemented the Center-Wide Sampling and Analysis Program (CWSAP), to evaluate potential soil and groundwater issues at NASA Ames. The CWSAP identified ten (10) Areas of Investigation (AOIs) at ARC. Seven (7) additional AOIs have been designated since that time when new information has been identified indicating the need for further investigation and possible remediation. The 1994 CWSAP and subsequent evaluations identified areas of potential soil and groundwater contamination from any source. The designated AOIs, shown on Figure 19-2, encompass broad areas containing potential NASA and/or non-NASA sources of contamination requiring further investigation.

Certain cleanup areas at NAS Moffett Field have been designated as "Sites" or "Operable Units," or "OUs," under the Navy Moffett FFA which require the Navy to implement investigations and response actions at Moffett, as shown on Figure 19-2. Some Navy-designated Sites include NASA AOIs. Certain of these Sites require ongoing ICs to ensure protectiveness.

The MEW Regional Plume constitutes a Superfund Cleanup at the Site that requires ongoing investigation, remediation, and implementation of ICs to ensure protectiveness. The MEW Regional Plume includes both NASA AOIs and a Navy OUs, as shown on Figure 19-2.

NASA Ames has executed a FFA with US EPA Region IX and the State of California. The general purposes of this FFA are to:

- Ensure that the environmental impacts associated with NASA's past and present activities at the Site are thoroughly investigated and appropriate remedial action taken as necessary to protect the public health, welfare and the environment;
- Establish a procedural framework and schedule for developing, implementing and monitoring appropriate response actions at the portions of the Moffett Field Site where NASA was a source of contamination, in accordance with CERCLA, as amended by SARA, the NCP, Superfund Guidance and policy, RCRA, RCRA Guidance and policy, and applicable state law;

- Ensure that response actions taken by the Navy and by the MEW Companies on the Site currently owned by NASA that require implementation of LUCs in order to be fully protective of human health and the environment are completed through landowner implementation of those associated LUCs, and
- Facilitate cooperation, exchange of information and participation of the Parties in such actions.

The current areas undergoing investigation or restoration by the Navy, NASA and other responsible parties on NAS Moffett Field and ARC are shown on Figures 19-1-19-3 and are described below.

19.4.1.1 *Areas of NASA ARC Responsibility*

Area of Investigation (AOI) 14: AOI 14 consists of three peninsulas, the twelve-acre Former Soils Fill Area (FSFA), Building N217 Fill Area, and Building N217A Fill Area, within the northern SWRP that serves as actual and potential habitat for several ecological receptors. ARC deposited fill within AOI 14 that contained PCBs, DDT, lead, chromium, cadmium and zinc.

AOIs 3, 7, and 9: AOIs 3, 7, and 9 were broad areas identified for investigation of potential ARC and Navy source areas to groundwater contamination that contribute to the MEW Regional Plume. This groundwater contamination is primarily VOCs. In accordance with EPA's 1989 MEW Study Area ROD, the MEW Companies, the Navy, and NASA have been operating groundwater extraction and treatment systems to address and control various portions of the MEW Regional Plume. These activities are conducted by the Navy under the 1990 Moffett FFA with the Navy and under a UAO and CD with the MEW Companies. To date, NASA Ames has been implementing the remedy in its designated area of responsibility pursuant to a separate agreement with the MEW Companies.

AOI 3 includes a number of formerly independent AOIs, specifically (1) AOI 1 - Former N-211 Jet Fuel Depot; (2) AOI 2 - N239, N239A, N210, N243 and N243A Area; (3) AOI 3 – USTs in N248A, N248B, and N259 Area; (4) AOI 3 East - N248, N248C and N248D Areas; and (5) AOI 12 – the N211 Hangar Area. Any remediation of these areas would be addressed in accordance with EPA's 1989 MEW Study Area ROD. NASA Ames has entered into a separate agreement with the MEW Companies concerning allocation of work for AOI 3 under which NASA Ames is conducting the remediation of petroleum compounds and the MEW Companies are conducting remediation of the VOCs. No wells are specifically associated with these areas at this time.

AOI 7 includes Navy Site 8 North and ARCs' Vertical Takeoff and Landing Pad. Historic documents indicate that solvents and oils were released from drums stored by the Navy at Site 8. Previous actions included the removal of both contaminated soil (excavation and disposal) and groundwater (excavation pit dewatering, treatment and discharge) by ARC. In 2000, ARC installed two extraction wells (NASA-3A and NASA-4A) in the shallow A Aquifer at AOI 7 for treatment of Navy Site 8 VOC releases within the MEW Regional Plume.

AOI 9 was originally identified by NASA Ames for further investigation of potential sources contributing to the MEW Regional Plume. No NASA Ames or other sources have been

identified in the area of AOI 9, however NASA Ames has agreed to take responsibility for Regional Plume activities in this area under its agreements with the MEW Companies. NASA Ames remedy operation and data reporting feed into Navy and MEW Companies monitoring reports on the MEW Regional Plume. Groundwater contamination was found to be elevated in this area, and, in 2000, NASA Ames installed two extraction wells (NASA-1A and NASA-4A) in the shallow A Aquifer downgradient of Building N240. NASA-2A (AOI 7) and NASA-4A (AOI 9) were shutdown in 2009 due to low performance and have not been returned to service or replaced.

Vapor Intrusion: EPA amended the 1989 ROD to select a vapor intrusion remedy for the MEW Superfund Site in its August 16, 2010 ROD Amendment for the Vapor Intrusion Pathway (2010 MEW ROD Amendment). The 2010 MEW ROD Amendment addresses the potential long-term exposure risks from TCE and VOCs through the vapor intrusion pathway. Vapor intrusion is an exposure pathway from the shallow subsurface contamination that is currently being addressed by actions under the MEW Superfund Site's 1989 ROD.

The primary source of vapor intrusion into buildings within the MEW Superfund Site is TCE contamination in the shallow groundwater; accordingly, the Vapor Intrusion Study Area is generally defined as the area where TCE concentrations in shallow groundwater are greater than 5 μg/L, or ppb. In September 2011, EPA worked with the MEW Companies, NASA Ames, and the Navy to develop the Statement of Work (SOW) for the Vapor Intrusion Remedy Remedial Design and Remedial Action (September 2011 SOW). All work required pursuant to this September 2011 SOW is referred to herein as Vapor Intrusion Work.

Pursuant to an agreement among NASA Ames, Navy, and the MEW Companies, each entity is responsible for implementing the Vapor Intrusion Remedy in a designated area, as depicted on the map attached as Figure 19-3. Pursuant to an agreement between the MEW Companies and NASA, ARC is responsible for implementing the Vapor Intrusion Work within the Vapor Intrusion Study Area – Moffett Field Area in the area designated as the "NASA Vapor Intrusion Area." The MEW Companies and the Navy are responsible for conducting the Vapor Intrusion Work in other designated areas under their respective enforcement instruments.

AOI 6: The Lindbergh Avenue Storm Drainage Channel/Ditch ("Ditch") was an approximate 2000 foot-long open, concrete-lined channel located along Lindbergh Avenue in the northeastern portion of NASA Ames that collected runoff from McCord Road, King Road, Severyns Road, the aircraft ramp and western portion of NAS Moffett Field, including the area surrounding Hangar 1. The channel was closed in 1993 with the replacement of a new storm drain system that drains stormwater from NASA Ames and the western areas of NAS Moffett Field to the SWSB located within the Eastern Diked Marsh in the northwestern portion of NASA Ames. Contaminants of concern associated with the former ditch were PCBs (Aroclors 1254, 1260, 1262 and 1268), lead and petroleum constituents. NASA Ames conducted investigation and remediation at AOI 6 in 1994-1996, 2000 and 2001. In 1994, the concrete liner was removed and the entire length of the ditch south of the diversion box was over-excavated to a depth of approximately 3.5 feet. In 2000, additional soil samples were collected along the entire length of the former ditch, and in 2001, additional soil north of the

diversion box exceeding the then-existing petroleum, lead and PCB cleanup levels for NASA Ames and Navy IR Site 25 was removed. Upon completion of the 2001 excavation, the entire ditch was backfilled with imported soil to match the surrounding topographic conditions. A completion report describing NASA's activities at AOI 6 will be submitted to document the cleanup actions taken at AOI 6 to date and determining whether future action is necessary.

Storm Water Settling Basin: The SWSB is a concrete basin approximately 100 feet long and 75 feet wide that receives all of the stormwater drainage from NASA Ames. The SWSB is located within the boundaries of Navy Site 25 Eastern Diked Marsh and the outfall from the SWSB enters the Eastern Diked Marsh. The primary contaminants in the sediment from the SWSB are PCBs, DDT, lead, and zinc. NASA Ames conducts annual sampling and maintenance of the settling basin and settling basin outfall area and provides the data to the Navy. These annual reports should be provided to EPA and the State. These areas will be further assessed to determine whether potential NASA Ames sources are impacting Navy Site 25.

Hangar 1: Hangar 1, Navy Moffett Site 29, was constructed by the Navy in 1932 to house the giant airship U.S.S. Macon. The hangar's floor space covers 8 acres, and it stands 200 feet high. The building materials and paint used to construct Hangar 1 contain PCBs, asbestos, lead and zinc. Contaminants in these materials moved into the environment around the hangar and, ultimately, reached AOI 6 and Navy Site 25 through the storm drain system. In 2003, the Navy completed a time-critical removal action that coated the exterior of Hangar 1 to seal the materials on the building surface. In July 2008, the Navy issued an Engineering Evaluation/Cost Analysis recommending removal of the Hangar 1 siding and coating the structural steel frame, and in January 2009, the Navy signed an Action Memorandum documenting selection of this recommended alternative. The Navy has removed the Hangar siding, coated the steel frame, and has finalized the After Action Completion Report and Long-Term Management Plan addressing long-term maintenance and LUCs. A Final ROD to finalize the Hangar response actions is currently being developed by the Navy. Although this is a Navy OU, and NASA is not a source of contamination at Hangar 1, NASA Ames has agreed to take over operation and maintenance of the following specific elements of Hangar 1: (1) walkway to the beacon, (2) clam shell door hinge pins, (3) thirty-six trucks supporting the doors, (4) the four door gear drive motors, and (5) the hangar's electrical vaults (with the exception of electrical vault five). NASA will document and perform remedy operation and maintenance of these elements, as well as any operation and maintenance elements that NASA agrees to implement, in a NASA-specific long-term management plan for Hangar 1. The Navy remains responsible for the operation and maintenance for all other portions of the Hangar 1 remedy, including maintenance of the coating on the structural steel frame. As land owner, NASA is responsible for LUCs associated with the Navy's ROD for Hangar 1.

19.4.1.2 *Areas Subject to NASA Land Use Controls*

Navy Installation Restoration (IR) Sites 1 and 2: Navy IR Sites 1 and 2 are former landfills located in the northern portion of NAS Moffett Field and make up Navy OU1. The Site 2 Landfill is now referred to as the Site 2 Former Landfill, because the waste material was removed and transferred to Site 1 as part of remedy implementation and Site 2 was

closed with No Further Action status in 2003. In 1997, the Navy and regulatory agencies signed the OU1 ROD. The Navy installed a multi-layer landfill cap at Site 1 in November 1998. Long-term maintenance of the cap and landfill gas and groundwater monitoring at Site 1 began in 1999 to ensure that the landfill was not emitting unacceptable levels of gas and that contaminants were not leaching into the groundwater or the San Francisco Bay. The OU1 ROD also listed the ICs that needed to be implemented for the Site. Two Five-Year Reviews for OU1 have been completed (2002 and 2007), each concluding that the remedy continues to be protective of human health and the environment in the short term, but noting that for long-term protectiveness, ICs needed to be implemented.

Navy IR Site 22: The Site 22 landfill covers 11 acres. The Navy operated the landfill from approximately 1950 to 1967, primarily for domestic waste disposal. The landfill waste is buried a minimum of 3 feet below the ground surface. By 1973, the Site 22 landfill had been converted into holes 3, 6 and 7 of the Moffett Field Golf Course. Between 1994 and 1999, the Navy conducted an RI of the soil and groundwater and characterized the type and extent of contaminants throughout Site 22. Site 22 soil and groundwater contain VOCs, semi-volatile organic compounds, and pesticides. Groundwater monitoring is being conducted by the Navy to ensure that contaminants are not migrating away from Site 22. In June 2002, the Navy issued a ROD signed by EPA and the Regional Water Board selecting use of a biotic barrier as the Site 22 remedy in order to prevent animal access to the landfill and listing the Site 22 ICs. The biotic barrier was completed in August 2003. Regular maintenance and long-term monitoring of groundwater and landfill gas is ongoing at Site 22 by the Navy, as required under the September 2003 Post-Construction Operations, Maintenance, and Monitoring Plan. The Navy completed a Five-Year Review for the Site 22 Landfill in 2008 which concluded that the remedy continues to be protective of human health and the environment in the short term, but noting that for long-term protectiveness, ICs needed to be implemented.

Hangar 1: The Navy addressed long-term maintenance of the Hangar 1 Removal Action in the June 2013 Hangar 1 Final Long-Term Management Plan, which referenced ICs to be selected in the Final ROD for the Hangar. The Navy is developing a Final ROD for the Hangar which includes LUCs for the Navy Hangar 1 response actions.

Vapor Intrusion Remedy: EPA's 2010 ROD Amendment for Vapor Intrusion includes the use of ICs to ensure the ongoing implementation of the Vapor Intrusion remedy. These ICs include preventing interference with the current implementation of the Vapor Intrusion remedy, ensuring ongoing implementation of the remedy in future development, and providing information to building occupants about the remedy being implemented. With regard to all areas of the Site currently owned by NASA that are part of the MEW Vapor Intrusion Study Area, the Vapor Intrusion Work for NASA includes implementation of those ICs.

19.4.1.3 *NASA Areas of Investigation within the Ames Campus*

AOI 4 consists of the courtyard area within the NFAC (40- by 80-Foot and 80- by 120-Foot wind tunnels). Several of the underground storage tanks leaked, and all have been removed. Soil and groundwater has been impacted by Jet Fuel and gasoline contaminants. ARC is implementing groundwater monitoring under a voluntary agreement with the DTSC.

AOI 5 includes two electrical substations (Buildings N-225 and N-225A), a drum storage area, and one underground storage tank located in the western portion of the Ames Campus. The drum storage area was closed in the mid-1980s, and the tank was removed in 1990. The electrical substations remain. Analyses of soil and groundwater samples from within AOI 5 have detected petroleum hydrocarbons, PCBs, and VOCs. The oversight agency for AOI 5 is DTSC.

AOI 8 is referred to as the Navarro farms area and includes Building N-267 and a bioremediation pad located at the northwest corner of ARC. Excavation of petroleum-impacted soil was completed and the site was closed by the DTSC.

AOI 10 includes three electrical substations not included in other AOIs. Transformer oil containing PCBs was used historically in many transformers. Excavation of PCB-contaminated soils at the Building N-221C Substation was completed and AOI 10 was closed by the DTSC.

AOI 11 includes 14 existing or former underground storage tanks at nine sites not located in other AOIs. . All of the three former single-wall tanks at the Building N-251 motor pool were replaced with two double-wall tanks and the remaining tanks were removed. Contamination remains at Tank Sites 7 and U-14. New Tanks 25 and 26 (Motor Pool) are still in use. The remaining tank sites are now clean. The oversight agency for AOI 11 is DTSC.

AOI 13 is contained within Navy IR Site 25.

AOI 15 consists of the NASA Fuel Line, which was clean closed under oversight of Santa Clara County.

Orion Park Plume is a solvent-contaminated groundwater plume exists in the former Orion Park military housing area immediately adjacent to the west of ARC and has migrated onto the west portion of ARC. The regulatory agencies have not identified the responsible parties for the plume. ARC is voluntarily operating an air sparging and soil vapor extraction system located on the western ARC boundary to mitigate this plume.

19.4.1.4 *Navy Installation Restoration Program Sites*

Navy IR Site 1: The IR Site 1 landfill is described above, and is currently in long-term monitoring and maintenance by the Navy.

Navy IR Site 2: The Site 2 golf course landfill is described above and was closed.

Navy IR Site 3: The site consists of a ditch along the eastern side of Marriage Road approximately 6 feet below grade. Storm drains located in and near Hangars 2 and 3 discharged detergents, hydraulic fluids, oils, fuels, solvents, detergents, paint, and paint stripper into this ditch, parts of which are lined with concrete. Based on site investigations the Navy, EPA, DTSC, and RWQCB signed a No-Action ROD for site soil. The low levels of solvent contamination in the aquifer below the site are being addressed under Navy IR Site 26.

Navy IR Site 4 consists of a former, unlined industrial wastewater holding pond that received approximately 15 million gallons of wastewater from airfield operations,

including aircraft washing and equipment maintenance. It was removed, closed, and replaced by new ponds in the late 1970s. No unacceptable risks to human health were identified for soil and a No-Action ROD was signed in 1994 for soil. Solvent contamination in the shallow aquifer below the site is being addressed under IR Site 26.

Navy IR Site 5 is the main fuel facility for Moffett Field. The fuel farm is divided into two parts: Site 5 north and south. Originally, the fuel farm consisted of 10 underground bulk storage tanks and four aboveground storage tanks. Six of the underground tanks were removed in 1995 from Site 5 south. The remaining eight tanks, four underground and four aboveground, are located in Site 5 north. These tanks are planned for removal and closure by the Defense Logistics Agency. There is soil and groundwater contamination at both locations, with the heaviest contamination in Site 5 north. The Navy is currently studying the site as part of its petroleum sites evaluation and closure program to determine what remediation will be needed. There is no remediation effort currently underway at Site 5.

Navy IR Site 6 is an area just north of Hangars 2 and 3 where it is believed that liquid wastes from aircraft maintenance, including paint, paint stripper, oil, fuel, and solvents, may have been released before it was paved in 1979. The Navy reports that No Further Action (NFA) was approved by the regulatory agencies for site soil and that solvent contamination in the shallow aquifer below the site is being addressed under Navy IR Site 26.

Navy IR Site 7 comprises the paved/unpaved areas surrounding and including Hangars 2 and 3.Unpaved areas in the corners of each of the hangars were used to dispose of liquid wastes from aircraft maintenance, including solvents, fuel, paint, paint stripper, and hydraulic fluid. In addition, a power plant in the northeastern corner of Hangar 3 may have released solvents on unpaved areas around the hangar. The Navy reports that NFA was approved by the regulatory agencies for site soil and that solvent contamination in the shallow aquifer below the site is being addressed under Navy IR Site 26.

Navy IR Site 8 is a former chemical storage and oil transfer area located in the northeastern portion of ARC. From the 1940s through 1981, this area had a 19,000-liter (5,000-gallon) waste oil tank and sump, which reportedly also received transformer oils (possibly containing PCBs) and solvents. Oil spilled during transfer contaminated some soils on the site. The tank and sump were removed in 1981, and NASA remediated contaminated soils in the northern portion of Site 8 through excavation and offsite disposal in 1994. The Navy states that Site 8 is closed.

Navy IR Site 9 consists of an old fuel farm and NEX Service Station and includes two former groups of underground fuel tanks and their associated piping. Fuel leakage from the tanks and pipes contaminated both subsurface soils and groundwater. Groundwater contamination from Site 9 mixed with the solvents in the MEW Regional Plume, and is being remediated by the Navy's Westside Aquifer Treatment System (WATS). The Navy determined that the soil contamination met the RWQCB's requirements for low-risk closure, and no further work on the soil is planned by the Navy.

Navy IR Site 10 is known as the Chase Park and runway areas**.** Groundwater is contaminated with VOCs believed to be from the MEW Regional Plume and is being addressed under Navy IR Site 28.

Navy IR Site 11 is an area near the northeastern end of the runway that was used to test aircraft engines. The site is covered with a concrete and asphalt pad, but a small drainage depression likely carried spilled hydraulic fluid, waste oil, and fuel to the southern edge of the pad. The Navy reports that NFA was approved by the regulatory agencies for site soil and that solvent contamination in the shallow aquifer below the site is being addressed under Navy IR Site 26.

Navy IR Site 12 is the former fire-fighting training area north of Hangar 1 on the west side of the runway. Jet fuels spilled during training have contaminated subsurface soils. Most of the contaminated soil (5,500 cubic yards), was removed in 1993. Because Zook Road and the west parallel taxiway border the site, it was not possible to remove all of the contaminated soil. The Navy evaluated the remaining contamination at Site 12 and found that it was not a threat to human or ecological receptors. The Navy reports that the site is closed and no further work is planned.

Navy IR Site 13 is a paved area east of Hangars 2 and 3 that is used as a parking lot. A surface drainage ditch received industrial wastewater from equipment washing, leaks, and spills. The drainage ditch flows to the main storm sewer. The Navy reports that NFA was approved by the regulatory agencies for site soil and that solvent contamination in the shallow aquifer below the site is being addressed under Navy IR Site 26.

Navy IR Site 14 North includes two former underground tanks located near the former dry cleaning building (Building 88) just south of Hangar 1. Free product and extensive groundwater contamination (up to 150 feet below ground surface) from solvents (PCE, TCE) have been documented. The Navy is currently evaluating treatment options and is preparing a work plan for pilot study of in-situ chemical oxidation for source treatment. Also see description for Site 18.

Navy IR Site 14 South is the former CANG motor pool. There is both soil and groundwater contamination from two underground tanks and associated piping, which have been removed. Originally, a groundwater pump-and-treat system was used to remediate the site. Low permeability soils limited flow rates, however, so this approach was abandoned. Then a remediation system involving recirculating and treating the groundwater in place was operated. Currently, the Navy is allowing the site to attenuate naturally, although benzene levels in the groundwater still exceed the cleanup level.

Navy IR Site 15 includes nine sumps, one oil/water separator, and an underground storage tank which have been removed. The Navy reports that Site 15 is closed.

Navy IR Site 16 consisted of two catch basins that drained a concrete wash pad to an underground oil/water separator. They were removed, and no contamination was found. The Navy reports that Site 15 is closed.

Navy IR Site 17 is the sump for the paint shop, which received wastes including oil and latex-based paints, thinners, toluene, and turpentine. The sump and surrounding contaminated soils were removed in 1991. No contamination remains at the site and the Navy reports that Site 17 is closed.

Navy IR Site 18 is the sump on the northern (down gradient) side of the former dry cleaning building (Building 88). The sump was removed, and no contamination from it was

found. However, the dry cleaning building, foundation, and underground piping were demolished and removed along with approximately 300 cubic meters (400 cubic yards) of soils contaminated with cleaning solvents. See above description for Site 14 North.

Navy IR Site 19 includes four underground storage tanks that have been removed. One of the tanks is believed to be a source of the solvent contamination in the groundwater in the Eastside/Airfield area. Groundwater treatment is being addressed under Navy IR Site 26.

Navy IR Site 20 is an area north of Hangar 1 adjacent to the airfield where off-specification fuels were stored in aboveground tanks removed in 1982. Fuels spilled from these tanks accumulated in low areas near the taxiways, runways and Zook Road. Soil and groundwater are contaminated with low levels of petroleum products. The Navy has determined that Site 20 meets the criteria for low-risk closure, and states that the site is closed.

Navy IR Site 21 is a surface drainage ditch on the northern edge of the Eastside/Airfield area that carries some of the stormwater flow from the eastern side of ARC. Reportedly, waste fluids, including transmission fluid, hydraulic fluid, and motor oil, were dumped here. The Navy reports that this site is closed.

Navy IR Site 22 is described above, and is currently in long-term monitoring and maintenance by the Navy.

Navy IR Site 23 is a former, 2-acre landfill approximately located immediately south of the northern weapons bunker area. There is no record of the source of the landfilled material, but construction and landscaping materials such as concrete, asphalt, grass clippings, and mulch have been observed at the site. Aluminum airplane parts and electronic equipment were also observed. There is no evidence of any hazardous materials, and the Navy states that the site is closed.

Navy IR Site 24 includes the fuel pits in Hangar 1, the high-speed fuel facility on the east side of the base, and the fuel wharf. No petroleum contamination was found at the Hangar 1 fuel pits, though there are solvents in the underlying groundwater. Minor amounts of contamination were found at the fuel wharf and the high-speed fuel facility. The Navy states that the site is closed.

Navy IR Site 25 includes the Eastern Diked Marsh and northern SWRP. The Navy completed sediment removal to address ecologic risk from PCBs, pesticides, and metals. The Navy reports that the site is closed and is currently completing pickleweed restoration in the pond area.

Navy IR Site 26: Site 26 consists of two distinct chlorinated VOC groundwater plumes located east of the NAS Moffett Field runways, in the area of Hangar 3, that impact the upper portion of the A aquifer. In 1996, the Navy and regulatory agencies signed the OU 5 ROD for the Site 26 remedy. In 1999, the Navy began operation of the East-side Aquifer Treatment System (EATS). The remedy for the southern plume required extraction and treatment until contaminant levels meet drinking-water (MCLs, groundwater monitoring, and implementation of ICs to prevent human exposure to, or ingestion of, contaminated groundwater. The remedy for the northern plume only requires groundwater monitoring. In 2003, the Navy proposed to replace the existing remedy with biostimulation/bioaugmentation, monitored natural attenuation, and new ICs, and a draft

ROD amendment was approved in 2014. EATS was turned off in 2003. Two Five-Year Reviews for Site 26 have been completed (2005 and 2010), each concluding that the existing remedy continues to be protective of human health and the environment in the short term, but noting that ICs need to be implemented in order to reach long-term protectiveness.

Navy IR Site 27 includes the Northern Channel, North Patrol Road Ditch, and Marriage Road Ditch. The principal contaminant is PCBs. The Navy completed excavation of contaminated sediments and reports that the site is closed.

Navy IR Site 28 consists of the WATS for remediating the Navy's area of responsibility within the MEW Regional Plume.

Navy IR Site 29 is Hanger 1 and is described above**.**

19.4.1.5 *Other Potential Sources of Hazardous Materials*

This section summarizes known information regarding storage tanks, lead-based paint, asbestos, PCBs, spent abrasive materials, radon, mold, medical/biohazardous waste, and pesticides at ARC.

19.4.1.5.1 Storage Tanks

Several hundred underground storage tanks have been present at ARC; most of them have been removed. The removed tanks are in various stages of the closure and/or remedial investigation process. Many of the aboveground storage tanks, sumps, and oil/water separators were also removed. Tanks that were still needed and in compliance were kept, while others were replaced with double-wall tanks.

19.4.1.5.2 Lead-Based Paint

Many of the buildings at ARC have been surveyed for lead-based paint. Because lead-based paint was in common use before 1978, it is assumed that the majority of the buildings at ARC contain it. Sampling has also found lead contamination in the soils surrounding some of the buildings that had lead-based exterior paint.

19.4.1.5.3 Asbestos

As with lead-based paint, most of the buildings at ARC have been tested for asbestos-containing materials (ACMs). ACMs were in common use into the 1970s and were found in almost all of the buildings tested. Common ACMs at ARC include pipe lagging, floor and ceiling tile, sheetrock, waterlines, and gasket material.

19.4.1.5.4 Polychlorinated Biphenyls

There is a substantial amount of documentation of the presence of PCBs at ARC, including a base-wide inventory conducted by the Navy prior to handover, and quarterly inspections still being carried out by the NASA Environmental Management Division in compliance with 40 CFR 761. Known items containing PCBs include capacitors, regulators, oil fuse

cutouts, oil circuit breakers, oil switches, transformers, and fluorescent light ballasts. Many of the known pieces of equipment with PCBs have already been removed and disposed.

Known PCB-containing equipment at ARC is either in service, in storage, or has been disposed (Table 19-1). ARC's 2013 annual document log reported 1 PCB transformer (containing >500 ppm PCBs), 1 PCB-contaminated transformer (containing 50-499 ppm PCBs), and 4,374 PCB capacitors (containing >500 ppm PCBs) on site.

Table 19-1. Weight of PCB (kilograms) in PCB-Containing Equipment at NASA Ames, 2010-2012

PCB materials	2010	2011	2012
In Service[21]	53,868.24	53,868.24	53,953.34
In Storage	0	0	0
Disposed[22]	25,428	18,851	21,692
Source: NASA 2013.			

In 2001, sampling conducted by NASA at the Bay View Area found no PCBs. Low concentrations of metals and pesticides were found. There are two known contamination sites south of the Bay View area at the down gradient end of the offsite Orion Park plume, AOI 5 and AOI 11. NASA is working on the Removal Action Work Plans for these two sites.

19.4.1.5.5 Mold

Different mold varieties can cause a range of illnesses, including infectious diseases, allergies, and dermatitis. Mold has been detected in various buildings within ARC. NASA has issued guidelines with precautions for entering these buildings.

19.4.1.5.6 Pesticides

Currently, NASA uses the herbicides Round-up, Rodeo, Direx 4L, Surflan, and Turflon, and the pesticides Gas cartridges, Maxforce gran, Tempo dust, Avert, Terro ant bait, Dragnet, and BP 100. A number of other pesticides were used at Moffett Field in the past, and there is a potential for residual levels of chemicals in soil. In particular, the pesticide dieldrin has been found in surface soil samples in the Bay View area in concentrations above residential risk-based screening levels.

Tables 19-2 and 19-3 identify annual quantities of the herbicides, insecticides, and pesticides used on site, as well as the purpose, method of application, and annual quantity used. Pesticide and herbicide use is confined primarily to the developed portions of the site. The Santa Clara County Vector Control addresses Mosquito abatement.

Table 19-2. Herbicide Usage at NASA Ames

Chemical	Purpose	Amount Used (lbs/kg)
Round-up	Post-emergent weed control	181/82

[21] The amount of PCB materials in service is the actual weight of pure PCBs.

[22] The total amount of PCBs disposed includes PCB-contaminated and PCB-containing wastes.

Chemical	Purpose	Amount Used (lbs/kg)
Rodeo	Post-emergent aquatic weed control	12/5
Direx 4L	Post-emergent weed control	496/225
Surflan	Pre-emergent weed control	49/22
Turflon	Ester herbicide	86/39
Notes: Herbicide usage between January 1 and December 31, 1998 lbs/kg = pounds per kilogram Source: NASA 2009.		

Table 19-3. Pesticide Usage at NASA Ames

Chemical/Devices	Purpose	Amount Used (lbs/kg)
Gas cartridges	Gopher and ground squirrel control	40 each
Maxforce gran	Ants and cockroach control	90/41
Tempo dust	Ants, roaches, spiders, gnats, and fleas	0.75/0.34
Avert	Cockroach control	0.28/0.125
Terro ant bait	Ant control	13/6
Dragnet	Flea control	0.25/0.11
BP 100	Cockroaches and spiders	0.75/0.34
Notes: Pesticide usage between January 1 and December 31, 1998 lbs/kg = pounds per kilogram Source: NASA 2009.		

A licensed contractor is responsible for the storage and application of pesticides, herbicides, and insecticides. Chemicals are not stored on site. Materials are mixed off site and brought to ARC in a diluted form for application. All herbicides are applied by hydraulic or backpack sprayer. Surplus materials are removed from ARC.

Ames Exchange is responsible for landscape maintenance of the Moffett Field Golf Course. Prior to application of any chemicals, ARC's maintenance staff posts warning signs in the area and notifies nearby occupants. Coordination of activities ensures that potential adverse health effects on humans and the environment are avoided.

19.4.1.5.7 Radiation

There are numerous sources of radiation at ARC (Table 19-4). They are dispersed throughout the site and used principally for discrete research projects.

Table 19-4. Sources of Radiation at NASA Ames

Ionizing Radiation	Potential Population Exposed	Source	Regulatory Reference
Radioactive materials	200	Laboratory radioisotopes N-239 and N-246	10 CFR 20, Safety Review of new operations, NASA APR 8715.1, Chapter 7
Radioactive materials	100	Sealed Radioactive Sources, N-213, N-236, N-239, N-245, N-246	10 CFR 20, Safety Review of new operations, NASA APR 8715.1, Chapter 7
Radioactive materials	200	Tritium Exit signs, N-220, N-221, N-226, N-234, N-239, N-240, N246B	10 CFR 20, 10 CFR 31, NASA APR 8715.1, Chapter 7

Ionizing Radiation	Potential Population Exposed	Source	Regulatory Reference
Radioactive materials	100	Industrial Radiographies (Iridium 192) centerwide	10 CFR 34, Safety review of new operations, NASA APR 8715.1, Chapter 7
Radioactive materials	5	Moisture density gauge (cesium/americium) N-246, and centerwide	10 CFR 20, 10 CFR 30, Safety review of new operations, NASA APR 8715.1, Chapter 7
Radiation machines	40	X-ray machines, Electron microscopes Buildings N-230, N-234, N-236, N-237, N-239, N-240, N-242, N-244, and N-255	CCR Title 17, Safety review of new operations
Radar	20	Radar transmitters/Receivers centerwide	ANSI/IEEE C95.1, NCRP Report #86, Safety review of new operations, NASA APR 8715.1, Chapter 8
Microwaves	50	Microwave transmitters, research use of microwave energy, centerwide	ANSI/IEEE C95.1, NCRP Report #86,Safety review of new operations, NASA APR 8715.1, Chapter 8
Incoherent UV	40	UV lamps, N-223, N-229, N-239, N-240, N-245,	ACGIH BEI & TLV, Safety review of new operations, NASA APR 8715.1, Chapter 8
Coherent Infrared, UV, and visible spectrum	250	Lasers (total of about 100) at various fixed and temporary locations throughout center	ANSI Z136.1, Safety review of new operations, NASA APR 8715.1, Chapter 8
Source: NASA 2009; Packard 2014.			

Sources of ionizing radiation at the site include numerous sealed and unsealed sources of radioactive materials in laboratory use, a moisture density gauge, radiation detection equipment calibrator, a gamma irradiation device, and a variety of X-ray-generating machines used mostly for research purposes. The primary radioactive isotopes used at ARC in laboratory experiments are carbon-14, Phosphorous-32, Iodine-125, Sulfur-35, and tritium (Hydrogen-3). Low to high activity sealed sources of Cesium-137, Strontium/Yttrium-90, and Americium-241 are used for various laboratory research and animal/sample irradiation. Large industrial sources of iridium are brought on site by offsite contractors and used for industrial radiography. The quantities of radionuclide in use generally are expressed in microcuries or millicuries.

Sources of nonionizing radiation at the site include lasers, microwave, radio frequency transmitters, and UV radiation (UV lamps) used for research and routine uses. Much of the research use includes Class 3B and Class 4 lasers. The lasers are used in laboratories, wind tunnels, on the runways, and on experimental aircraft. Microwave and radar units are used primarily by the Ames communications group in Code IO and for some research purposes including ground penetrating radar, solid waste water recovery processing. A small group of researchers is investigating the biological and physical properties of UV radiation. There are numerous sources at ARC of Extremely Low Frequency and Ultra Low Frequency radiation, which have not been shown to be harmful. The Non-Ionizing Radiation Safety

Committee and the Radiation Safety Committee provide oversight for the safe use of these radiation sources. Radioactive waste is stored in a decay-in-storage facility licensed by the Nuclear Regulatory Commission (NRC). A commercial radioactive waste broker removes radioactive waste materials not maintained for decay or containing RCRA-controlled materials from the site to be disposed of off-site at licensed facilities.

19.4.1.5.8 Other Potential Sources

Some medical or bio-hazardous waste has been and is generated within ARC. At present, very small quantities of medical and bio-hazardous wastes are generated in three locations at the center due to research activities and the operation of the center's Health Unit. There are a few locations, such as the wind tunnels, where uncontrolled blasting could have occurred at ARC. Testing has not found any radon levels above the EPA's action levels.

19.4.1.6 *Adjacent Off-Site Contamination*

During the investigation and monitoring activities for NASA AOIs 4 and 11, low levels of TCE were discovered in the groundwater in Orion Park. In order to locate the source of TCE, NASA conducted several investigations. A review of well data and subsurface geology indicates that the TCE is coming from the offsite housing area, and then flowing beneath the western portion of the Ames Campus. The U.S. Navy is planning to continue with the investigation of Orion Park in order to determine the source of the TCE. NASA is also conducting further investigation of the area to better define subsurface conditions with the goal of implementing some control measures to prevent further migration of TCE onto the Ames Campus and to prevent its migration beneath Bay View. Potential hazardous materials contamination may also exist in the nearby Mountain View industrial area, where some hazardous materials users operate.

19.5 **Environmental Requirements**

NASA has identified the following environmental policies, practices, and measures that address potential hazardous materials effects of operations and future development at ARC.

19.5.1 **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.

19.5.2 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.

19.5.3 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.

19.5.4 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

19.5.5 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 potential hazardous materials effects from operations and future development at ARC.

- EWI 3-1, Aboveground Storage Tanks (AST)
- EWI 3-2, Underground Storage Tanks (UST)
- EWI 3-3, SPCC Plan
- EWI 4, Solid Waste and Recycling
- EWI 5, Chemical Management
- EWI 5-1, Hazardous Materials
- EWI 5-2, Hazardous Waste Management
- EWI 5-3, Toxic Gas Management
- EWI 5-4, Medical Waste
- EWI 5-5, PCBs
- EWI 6, Emergency Preparedness and Community Right-to-Know
- EWI 6-1, BEAP Program
- EWI 7, Closure Plan I
- EWI 8, Restoration

- EWI 9, Emergency Response
- EWI 10, Environmental Training (Under review)
- EWI 11, Instrument Calibration (Under review)
- EWI 12, Public Involvement
- EWI 14, NEPA and Environmental Justice
- EWI 17, Pollution Prevention/Affirmative Procurement (Under review)
- EWI 18, Environmental Requirements for Construction Projects (Under review)

19.5.6 **Hazardous Materials and Wastes**

A number of protocols are in place throughout ARC to control the hazards associated with hazardous substances and to minimize the risks of exposure or spills. NPRs and ARC's EWIs ensure that the center meets all federal, state, and local hazardous materials and hazardous waste regulations. The *Hazardous Waste Minimization Plan* prescribes actions that will reduce ARC's hazardous waste output.

Container management rules intend to decrease the impacts of hazardous materials. Container management general rules include:

- Limit storage to a 1-week supply, if feasible
- Return containers to storage location daily
- Keep containers tightly closed when not in use
- Do not remove or deface manufacturers' labels
- Label all containers to meet Hazard Communication or Lab Standard requirements
- Store corrosives below shoulder height
- Store poisons separately in a controlled area
- Store flammable liquids (> 10 gallons) in vented cabinets
- Store refrigerated flammables in a "desparked" refrigerator
- Segregate chemically incompatible materials
- Observe special rules for flammable and toxic gases
- Secondary containment for stored liquids and liquids in use

As discussed above, all hazardous material storage areas at ARC must comply with the Santa Clara County Hazardous Materials Storage Ordinance and Toxic Gas Storage Ordinance by obtaining and keeping current the appropriate permits (e.g. hazardous materials storage permits, toxic gas storage permits, temporary fuel tank permits, etc.). Detailed procedures for managing hazardous materials are found in EWI 5-1, Hazardous Materials Management. In addition, NASA implements internal policies and procedures to prevent accidental releases of toxic gas by users. The quantities of toxic gases stored on site

are limited and monitored quarterly to minimize impacts from an accidental release of toxic gas at ARC.

NASA's *Hazardous Materials Management Program* identifies sources of information on hazardous materials. The plan includes avenues for employees to choose the least hazardous material, minimize quantities of hazardous materials used, minimize the sources of hazardous waste, plan for appropriate storage, and plan for controls (including engineering (ventilation, and sensors), administrative (procedures), and personal protective equipment).

Various hazardous materials are used at ARC in research projects and day-to-day operations. It is a requirement for all ARC employees who handle hazardous waste to be trained in hazardous waste management, release response, and environmental essentials. Hazardous materials users are required to prepare accurate hazardous materials inventory statements (HMIS). Each HMIS includes the location, type, and amount of hazardous materials and associated hazards. ARC prepares a Center-wide HMIS annually; the centerwide HMIS is submitted to Santa Clara County's Hazardous Materials Compliance Division.

Each hazardous materials storage area is inspected regularly to ensure that all containers are in good condition and that secondary containment systems are free of liquid. Discrepancies are promptly corrected. ARC has implemented procedures for managing hazardous materials. These procedures are found in EWI 5-1, Hazardous Materials Management. All civil servants, contractor employees, and resident agency personnel at ARC who use, store, or manage hazardous materials are required to follow these procedures.

Toxic gases are used in various research projects and in day-to-day operations. These gases are typically contained in small lecture bottles and cylinders and must be stored in appropriate cabinets and controlled areas.

To minimize potential community impacts, a policy was implemented at ARC in spring 1997 that limits the quantity of toxic gas that can normally be used or stored on site. Toxic gas users that may require larger quantities would be required to prepare an offsite consequence analysis, in accordance with EPA and other applicable protocols, to determine the potential for impacting nearby communities during a worst-case release of toxic gas. ARC monitors the amount of toxic gas kept on site by completing quarterly inventories that document the type, location, and amount of toxic gas on site.

The Radiation Safety Committee supervises and monitors all activities at ARC that might involve radiation hazards. The Ames' Radiation Safety Committee is composed of the Radiation Safety Officer and members of the ARC scientific community experienced in the handling and safeguarding of radiation sources and radioactive materials. The Ionizing Radiation Committee authorizes use, prepares hazard analyses, establishes safety practices, and approves facilities in which radiation sources will be used, and generally supervises and monitors all ARC activities in which radiation hazards may be a factor.

The Radiation Safety Officer, appointed by Ames' Director with the concurrence of the NRC, works with the Ames' Occupational Safety, Health, and Medical Services Office performing

day-to-day radiation safety oversight. Radiation Safety Officer activities include training, maintaining controls of radioactive materials possession, experimental design, operation of ionizing radiation sources, administration of the NRC license audit, and measurement of all radionuclide-producing electronic emission devices. All ionizing radiation sources greater than NRC defined "generally licensed materials" are licensed or registered, depending on their use.

The Non-Ionizing Radiation Safety Committee oversees the use of nonionizing sources of radiation at the site. The Non-Ionizing Radiation Safety Committee is composed of the Laser Safety Officer and members of the ARC scientific community having experience in the handling and controls of nonionizing sources of radiation. The Non-Ionizing Radiation Safety Committee authorizes use, prepares hazard analyses, establishes safety practices, and approves facilities in which nonionizing radiation sources will be used, and generally supervises and monitors all ARC activities in which laser hazards may be a factor.

The Laser Safety Officer, appointed by the ARC Director, works with the Ames' Occupational Safety, Health, and Medical Services Office performing day-to-day laser safety oversight. Laser Safety Officer activities include training, evaluations of new laser projects, assistance in experimental design, checks for proper operation, internal audits, and operations safety procedures.

The *Hazardous Substance Reporting Protocols* set procedures for reporting hazardous substances to outside regulatory agencies, which is done by the NASA Ames Environmental Management Division. Other personnel report hazardous substance inventory to the NASA Ames Environmental Management Division, and report hazardous substance spills to the NASA Ames Dispatch Office, which activates the spill response system.

The *Hazardous Waste Disposal Procedures* at ARC require that all hazardous wastes be transported to secure, ventilated packaging areas, from which they are packaged and transported to state and federally authorized treatment or disposal sites.

The *PCBs Removal and Controlling Access Policy* is stated in the EWI 5-1, Hazardous Materials Management. PCB management requirements at ARC include quarterly inspections, training, reporting and recordkeeping, spill cleanup and reporting, safe storage, transportation, and disposal. ARC implements ongoing efforts to remove PCB-containing equipment and light ballasts per regulatory compliance and through the replacement of obsolete items.

The *Radioactive Waste Disposal Procedures* require that all radioactive wastes be stored in N-246 Room 190 which is a separate concrete building outside the main N-246 building. Approximately every 6 months, a licensed contractor removes the packaged waste from the site and takes it to authorized disposal sites within the United States. NASA is authorized to hold radioactive material with a physical half-life of less than 120 days for decay-in-storage before disposal. ARC is licensed by NRC to possess and use radioactive materials. The Radioactive Materials License, 04-07845-04, is administered under supervision of the Ames Radiation Safety Committee.

Chapter 7 of the Ames *Health and Safety Manual*, APR 8715.1; Titles 10, 21, and 49 of the CFR; and Title 17 of the CCR provide the controls and procedures used to regulate ionizing

sources of radiation. Chapter 8 of the Ames *Health and Safety Manual*, ANSI Z136.1, ANSI/IEEE C95.1, and 29 CFR (Occupational Safety and Health Administration section) provide the controls and procedures used to regulate nonionizing sources of radiation.

NASA has also developed a strategic plan to guide its facilities in compliance with EO 12969, *Federal Acquisition and Community Right-To-Know*. The EO, adopted August 3, 1993, sets out to ensure federal facility compliance with the chemical reporting requirements of the Emergency Planning and Community-Right-to-Know Act of 1986 (42 USC Sections 11001–11050) and the requirements of the Pollution Prevention Act of 1990 (42 USC Sections 13101–13109).

19.5.7 **Pollution Prevention**

ARC is in the process of implementing NASA's Environmental Excellence for the 21st Century strategy, which includes a pollution prevention plan consistent with the requirements of relevant federal and state regulations and laws. Pollution prevention refers to technology or operational changes that reduce the amount and/or toxicity of hazardous materials used and waste generated. Examples of pollution prevention practices include source reduction (through product substitution and source control), employee and management training in environmental best management practices, product redesign and process modification, reuse and recycling of materials, and treatment/disposal of wastes.

ARC has reduced solid and hazardous waste production, minimized impacts to the environment, and controlled air emissions through a variety of methods and technologies. In addition, ARC has routinely implemented recycling and educational programs to reach the ARC community and bring environmental issues to the forefront. In accordance with EOs 13514 and 13423, ARC's goal is to increase waste prevention, recycling, and the purchase and use of recycled content and environmentally preferable products and services. The following are some of the pollution prevention programs and activities that are currently being implemented at ARC. ARC implements NASA's pollution prevention strategy by:

- Operating the Ames Chemical Exchange (ACE)
- Maintaining accurate and up-to-date Building Emergency Action Plans and SPCC plans and ensuring that facility activities comply with the procedures within these plans
- Reviewing and revising standard construction specifications to incorporate pollution prevention measures into all phases of a project and inspecting major construction projects to ensure compliance
- Supporting and continually improving facility-wide recycling efforts
- Promoting employee awareness of environmental programs through training and active information dissemination
- Reducing the use and storage of hazardous materials through materials substitutions and more efficient procurement strategies
- Promoting affirmative procurement of recycled goods and services

- Identifying measures to reduce major hazardous waste streams

19.5.7.1 *Mulching*

All landscaping green waste is made into mulch in an area south of OARF for future landscaping use. A mulching program began in 1996 at ARC. At its inception, the program consisted of gathering yard waste from the Moffett Field Golf Course and composting it into green material active compost. During 1997, the program was extensively modified to include all landscape trimmings generated at ARC, and a limited amount of shredded paper. In addition, during scheduled periods, such as Pollution Prevention Week, employees are educated in the composting process and a composting open house is held at the mulching facility. This program has several benefits. It dramatically reduces the volume of material sent to landfills, saves money spent on landscape maintenance by reducing the purchase of soil amendments, and provides an educational opportunity for the ARC community.

19.5.7.2 *Recycling and Source Reduction*

ARC has implemented a single stream recycling program. Recycled materials included white paper, mixed paper, cardboard, plastics, toner cartridges, various types of batteries, fluorescent lamps, certain solvents, waste oil, oil filters, scrap metal, tires, computers, construction and demolition waste, empty drums, and plastic, glass, and glass containers. The motor pool currently recycles coolant, oil filters, and oils, and uses recycled oil. In addition, retread tires are used when possible. To minimize the amount of waste generated, ARC is dedicated to recycling used materials when possible. Reporting the quantities of recycled material is required for the following purposes:

- EPA biennial reporting for hazardous waste generators
- Annual Recycling and Sustainable Acquisition Report
- Annual recycling update questionnaire submitted to NASA headquarters
- Tracking progress toward established solid waste recycling goals
- Tracking progress toward hazardous waste minimization goals
- Tracking progress toward pollution prevention goals

19.5.7.3 *Electronic Waste Recycling*

NASA-owned computers and equipment that are surplus are managed by the Property Disposal Office, Code JSL. Ames computers that are turned in to the property disposal officer are staged in the N-255 warehouse for the required screening period. During this screening period, anyone at Ames or any other federal or state agency can claim the computer for internal government use. Equipment that is not donated or reutilized is sent to an approved processing facility for materials recovery within North America. The Ames Environmental Management Division, Code JQ, audits and approves the facility to ensure that the equipment is handled properly and that no e-waste is exported to overseas scrap markets, either directly or through recycling brokers.

19.5.7.4 *Affirmative Procurement*

ARC continues to promote affirmative procurement and uses recycled products whenever possible as the default items procured through Stores Stock, in accordance with RCRA Comprehensive Procurement Guidelines and EO 13514.
The following practices are incorporated into all ARC activities and operations to promote cost-effective source reduction and to enhance recycling.

- Recycled Products Purchasing - When purchasing/ordering items designated by EPA as being available with recycled content, all ARC employees and contractors shall purchase those items composed of the highest percentage of recovered materials practicable consistent with product performance requirements, quality, and safety.
- Recycled Paper Use - All employees shall order and use printing and writing paper made from recycled materials instead of products made from virgin materials. Printing and writing paper ordered shall contain at least 100% recycled fibers (paper meeting the 50% recycled content requirement is currently available from onsite Stores Stock).
- Double-Sided Photocopies - Reports, memos, and other paper documents shall be photocopied in double-sided format when possible.
- Electronic Communication - Employees shall transfer documents electronically when possible.
- Energy Conservation - All employees shall turn off lighting, printers, and other equipment when not in use and prior to leaving for the day, when feasible.
- Reusable Products - All employees shall order and use non-disposable products or products that promote reuse (for example, ballpoint pens with replaceable ink cartridges and rechargeable batteries).

19.5.7.5 *Energy*

ARC reduces energy use whenever possible through a combination of alternative source of energy projects, relamping initiatives, Center-wide e-mails, and use of the Energy Saving Program Contract. New facilities and equipment shall include specifications for conserving water and energy. Examples include energy-saving lighting devices and golf course uses recycle water.

19.5.7.6 *Chemicals and Ozone-Depleting Substances*

Unused chemicals that are in good and stable condition are reused on site through the ACE program. The ACE is a chemical redistribution program that promotes the use of surplus chemicals. By using ACE, individuals and organizations save money by eliminating the purchase of new chemicals and reducing or eliminating disposal costs of surplus chemicals.

It is the responsibility of chemical purchasers to check the ACE inventory for product availability prior to purchasing new chemicals. This can be done with the assistance of the Ames Hazardous Materials Specialist. Every attempt is made to provide the ARC

community with alternatives to the purchase of new chemicals. All chemicals on site are tracked through a HMIS to ensure safety and possible source reduction.

An ozone-depleting substance (ODS) is a chemical substance, usually consisting of some combination of chlorine, fluorine, or bromine plus carbon, such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) that has been shown to destroy stratospheric ozone (The Border Center 2014). These substances are commonly found in aerosol products, foams, and fire extinguishers, and are used as refrigerants and in air-conditioning and cooling equipment.

ODS are regulated under the Title VI of the CAA and are divided into two classes:

- Class I includes the fully halogenated CFCs, halons, and the ODSs that are the most threatening to the ozone layer.
- Class II compounds include HCFCs, which are known or can be reasonably anticipated to have harmful effects on the stratospheric ozone layer.

ODS at ARC are reduced and eliminated whenever possible through process modifications and chemical substitutions. ARC continues to manage its stockpile of halon, a fire extinguishing agent used in aircraft and space vehicle firefighting, while looking for non-ODS alternatives. Additionally, Ames collects old refrigerators and air-conditioning units prior to disposal and drains any CFC- or HCFC-containing refrigerants (NASA 2011b).

19.5.7.7 *Toxic Release Inventory*

As a federal facility, Ames complies with section 301 through 313 of the EPCRA, which sets forth requirements for Toxic Release Inventory (TRI) reporting. TRI reporting is only triggered when a facility exceeds one or more of the three activity thresholds for manufacturing, processing, and otherwise use. Threshold calculations are based on cumulative quantities of each TRI chemical manufactured, processed or otherwise used over the reporting year. Ames quantifies the amount of each TRI chemical and chemical category involved in each of these three activities and compares the amounts to the thresholds. The TRI Chemical list includes over 650 listed TRI chemicals and compounds. Ames has 156 TRI chemicals and 23 compounds known to be used or present on site. None of these chemicals or compounds met reporting thresholds for the most recent reporting year (2012) (ERT 2013).

The estimated mass of the top 10 TRI chemicals and compounds ranged from 2-47% of the mass thresholds for reporting after relevant exemptions are taken. Among these chemicals and compounds, polycyclic aromatic compounds, lead, lead compounds, mercury and mercury compounds are listed persistent, bioaccumulative, and toxic (PBT) chemicals. PBT chemicals have lower activity thresholds for reporting than other chemicals.

19.5.7.8 *Integrated Pest and Vegetative Management*

The impact of pesticide use on biotic resources on site is minimal because ARC applies Integrated Pest Management (IPM) and Integrated Vegetation Management (IVM), which are complementary programs that employ methods designed to reduce impacts to the environment.

Under the guidance of the Bio-Integral Resource Center, a research/educational organization specializing in IPM, the ARC IPM team was initiated in 1997 with a pilot project in six buildings. In 1998, IPM was expanded to include all buildings at ARC. IPM techniques replace traditional reactive pesticide applications with a monitoring and management approach that focuses on long-term pest prevention and reduced use of toxic substances.

IPM activities include designing a monitoring and recordkeeping system, testing treatment methods, improving building sanitation and pest proofing, training pest management staff, and educating building managers and occupants on IPM activities. The program replaces routine spraying of liquid pesticide formulations around buildings with a strategic placing of least-toxic, low-dose bait stations to control cockroaches, Argentine ants, and mice. Other IPM methods include use of least-toxic easily biodegradable pesticides, and use of visual barriers and habitat changes to contain ground squirrels.

Beginning in 1998, the IVM program began to expand. The use of goats for control of "stubborn vegetation" and the use of native plant species are two elements of the program. Other aspects of the IVM program include turf and field mowing adjustments (in which the timing of and height of cutting helps eliminate undesirable plant species) and use of least-toxic herbicides that are easily biodegradable. The IVM program is still developing, and alternative procedures for vegetation management are currently being explored for inclusion into the IVM program.

Prior to implementation of IPM and IVM, pesticide and herbicide application totaled 4,000 gallons. In 1998, combined pesticide and herbicide used dropped to 116 gallons, a 97% reduction since the inception of the IPM and IVM programs.

19.5.7.9 *Training and Awareness*

Training and outreach programs run throughout the year. Some of these activities include seminars, Center-wide e-mails, America Recycles Day, Earth Day, Pollution Prevention Week, organization-specific training, and a general Hazardous Waste and Environmental Essentials training course.

19.5.7.10 *Groundwater Reverse Osmosis Facility*

ARC operates a renovated facility that further treats decontaminated groundwater through reverse osmosis for use in selected research operations.

19.5.7.11 *Cleanup of Regional Plume*

EPA and the companies responsible for the MEW contamination signed a ROD in 1989 that included an agreement on how and to what level the MEW Superfund site would be remediated. EPA later determined that the cleanup of groundwater and soils at Moffett Field contaminated by the MEW plume was subject to the MEW ROD.

The Navy and the MEW companies are thus jointly conducting remediation under EPA supervision, with periodic monitoring to evaluate the progress of remediation efforts. As of 1997, both the Navy and the MEW companies had designed and installed coordinated permanent remediation systems. NASA has also contributed contamination in the northern

portion of the plume. In response, NASA has installed a remediation system that started operation in September 2001. EPA and the RWQCB are the oversight agencies for cleanup of the Regional Plume. Sampling has been conducted to determine whether of contaminant volatilization in the plume is contaminating soils or indoor air quality. The results of this sampling are discussed in Chapter 8, *Air Quality*.

19.5.8 NASA Ames Development Plan Final Programmatic Environmental Impact Statement

The NADP EIS identifies the following mitigation measures to address potential hazardous materials impacts from build out of NADP Mitigated Alternative 5.

19.5.8.1 *Mitigation Measure HAZ-1*

NASA's development partners would work with the Remediation Project Manager within the Office of Environmental Services during site planning and would implement the guidelines and recommendations in the Environmental Issues Management Plan (EIMP) to ensure that none of the proposed construction, demolition, and infrastructure improvement projects would expose personnel to unacceptable levels of contaminated soil or groundwater. Where the Remediation Project Manager determined that there would be a possible risk of exposure to people or clean soil or groundwater, the proposed design would be altered to prevent such exposure if feasible. If it were not feasible to avoid exposure, protective measures would be undertaken to minimize the risk of exposure as described in the EIMP.

19.5.8.2 *Mitigation Measure HAZ-2*

In Alternatives 2 and 4, NASA or its partners would locate childcare facilities at least 305 meters (1,000 feet) from the industrial area of Mountain View, which would limit the area in which industries handling hazardous materials would be prohibited. Mitigated Alternative 5 (the preferred, selected alternative) would locate childcare facilities at least 402 meters (1,320 feet) from the industrial area of Mountain View in accordance with City of Mountain View policy.

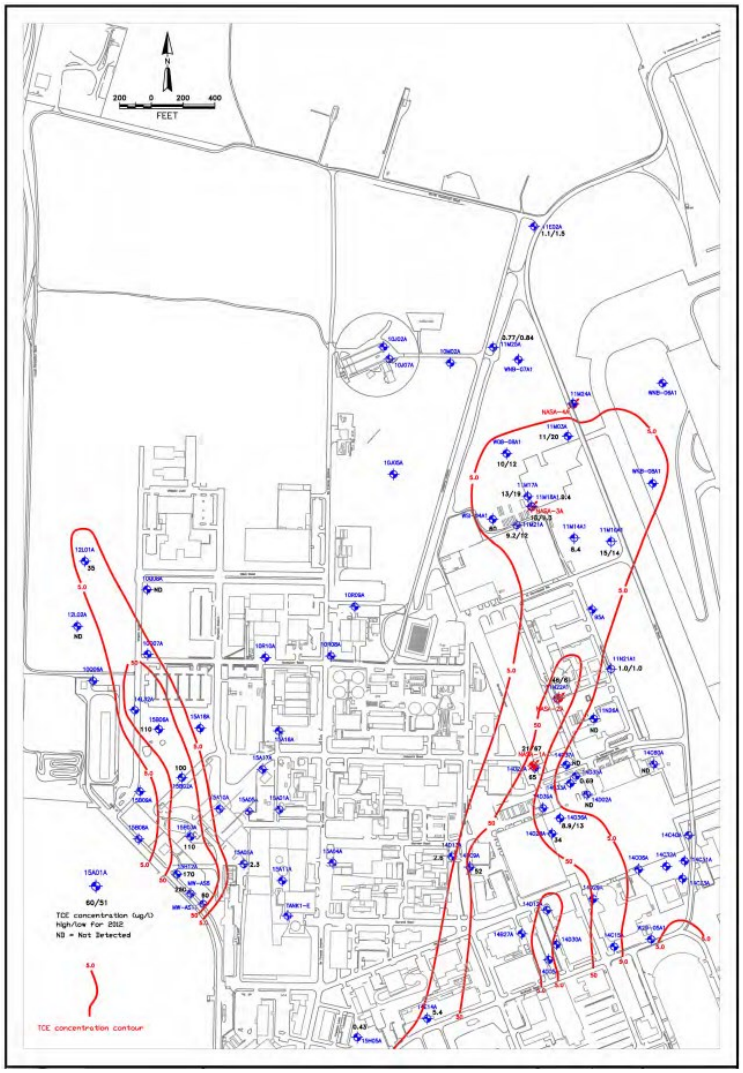

Figure 19-1. Extent of Regional Plume (right) and Orion Park Plume (left)

(Source: ERT 2014a).

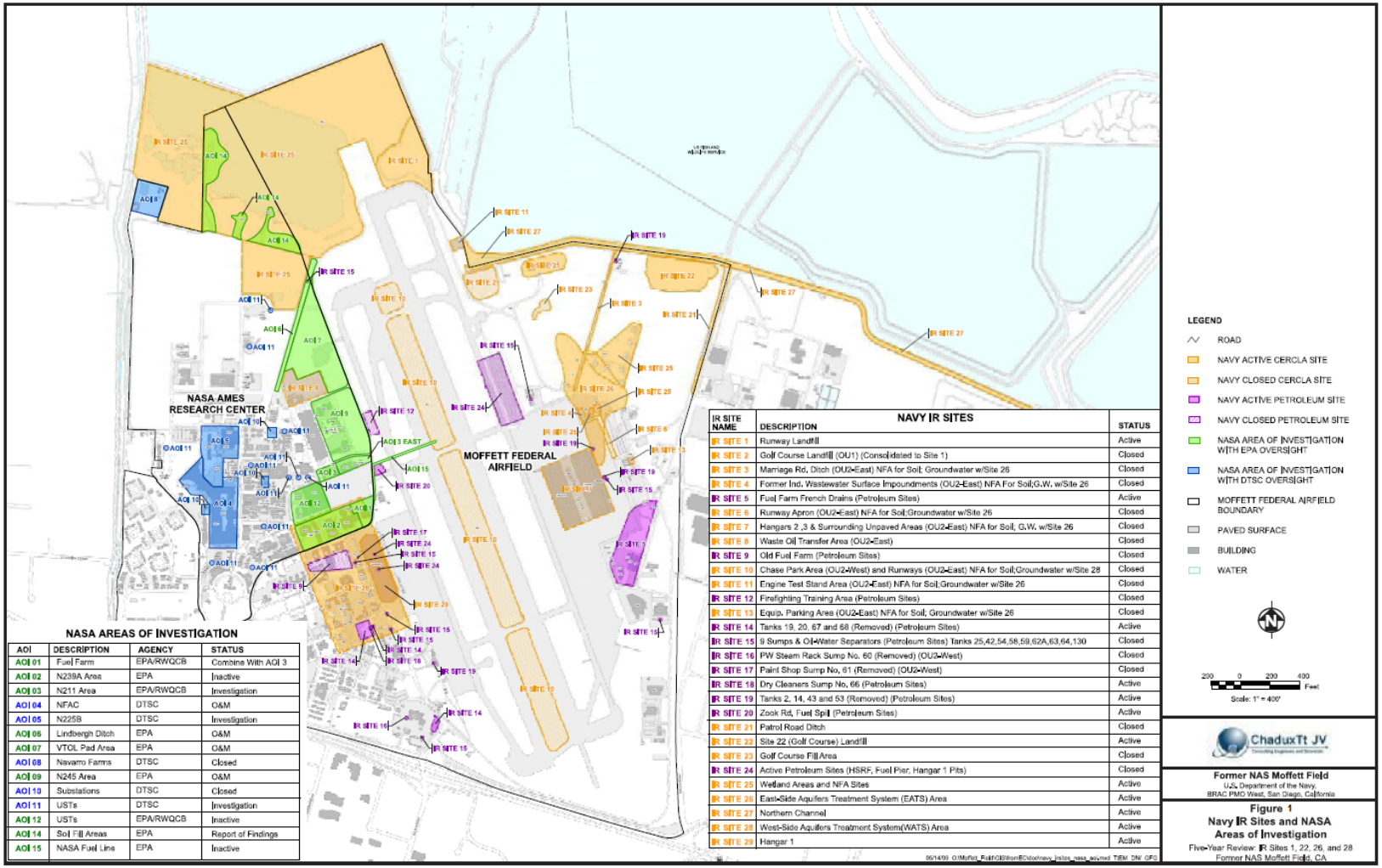

Figure 19-2. Restoration Sites

(Source: ChaduxTt JV 2010)

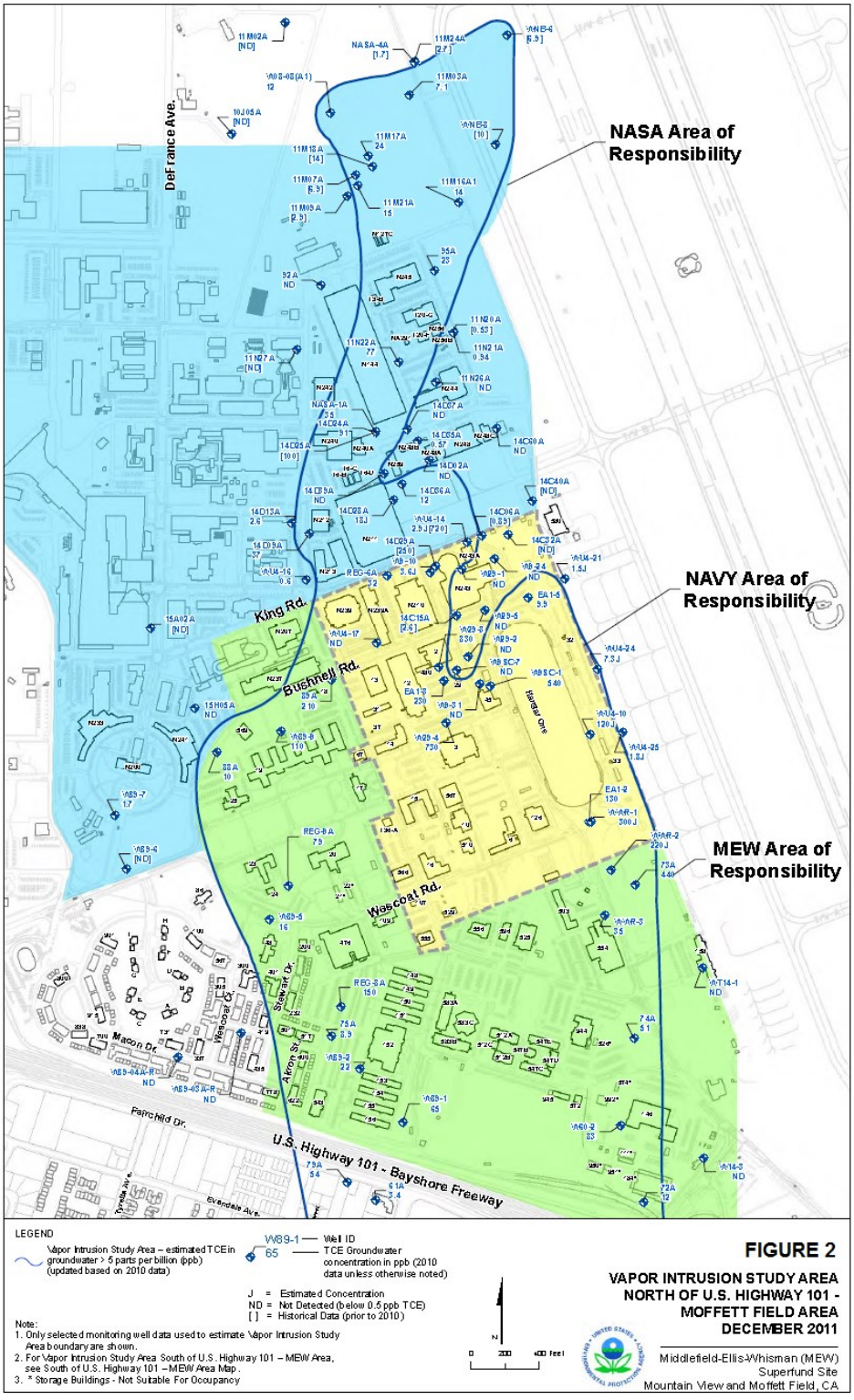

Figure 19-3. MEW Regional Plume and Vapor Intrusion Study Area

(Source: USEPA 2011)