PREFACE

In preparing this Historical Site Assessment (HSA) for the Santa Susana Field Laboratory Site Area IV Radiological Study, the U.S. Environmental Protection Agency (EPA) sought to provide the most comprehensive and far-reaching HSA possible. Among the voluminous amount of documents reviewed and ultimately used in preparing the HSA, several documents were used that have been identified as containing information potentially restricted by U.S. export control laws, including the Arms Export Control Act (22 U.S.C. section 2751 et seq.), the International Traffic in Arms Regulations (22 C.F.R. Part 120), the U.S. Department of Commerce's Export Administration Regulations (15 C.F.R. Parts 730-774), and the U.S. Department of Energy's Foreign Atomic Energy Activities Regulations (10 C.F.R. Part 810). These documents may only be reviewed by U.S. persons. U.S. persons are U.S. citizens, U.S. nationals, lawful permanent residents of the U.S., or persons who are protected individuals as defined by 8 U.S.C. section 1324(b)(a)(3) (certain refugees and grantees of asylum). Transfer of controlled information by any means to a non U.S. person, whether in the U.S. or abroad, without a valid export license or prior written approval from the Department of State, Department of Commerce, or other relevant federal agency, is prohibited.

In order to provide the HSA to the broadest audience possible without encumbrances, EPA has chosen to prepare a redacted version of the HSA to comply with U.S. law. This means that certain passages within this version of the HSA containing information potentially restricted by U.S. export control laws have been made illegible in order to protect this sensitive information while maintaining the original flow and organization of the HSA. It should be noted that as a percentage of the total HSA, the passages that have been redacted comprise less than 1 percent of the HSA.

Per agreement with EPA's interagency partner at the Santa Susana Field Laboratory Site, the California Department of Toxic Substances Control (DTSC), EPA has provided an unredacted version of this HSA, with all parts made legible, for public review should a member of the public wish to review the entire HSA. Members of the general public who wish to review the entire HSA without redactions should contact the DTSC and make an appointment to do so. At the time of the appointment, DTSC will verify whether the individual requesting the review is a U.S. person and only U.S. persons will be permitted to read the passages that have been redacted. However, the information presented in those passages will remain under the purview of U.S. export control laws and cannot be removed from the DTSC office or copied or transmitted in any form.

To make arrangements to review the full version of the HSA report, including information restricted under the export control laws of the U.S., members of the public should contact the following DTSC office:

California Department of Toxic Substances Control
9211 Oakdale Avenue
Chatsworth, CA 91311
Phone: (818) 717-6500

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FINAL
HISTORICAL SITE ASSESSMENT
SANTA SUSANA FIELD LABORATORY SITE
AREA IV RADIOLOGICAL STUDY
VENTURA COUNTY, CALIFORNIA

Prepared for:

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October 2012

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LIST OF ACRONYMS AND ABBREVIATIONS

AETR	Advanced Epithermal Thorium Reactor
AOC	Administrative Order on Consent
CD	compact disc
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Ci	Curie
D&D	decontamination and decommissioning
DOE	Department of Energy
DTSC	Department of Toxic Substances Control
USEPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
ETEC	Energy Technology Engineering Center
HGL	HydroGeoLogic, Inc.
HEPA	high-efficiency particulate air
HSA	Historical Site Assessment
kW	kilowatt
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mR/hr	milli roentgens per hour
MWd	megawatt days
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NRC	Nuclear Regulatory Commission
RMHF	Radioactive Materials Handling Facility
SBZ	Southern Buffer Zone
SCA	SNAP critical assembly
SNAP	Systems for Nuclear Auxiliary Power
SSFL	Santa Susana Field Laboratory
TM	technical memorandum

FINAL
HISTORICAL SITE ASSESSMENT
SANTA SUSANA FIELD LABORATORY SITE
AREA IV RADIOLOGICAL STUDY
VENTURA COUNTY, CALIFORNIA

1.0 INTRODUCTION

This Historical Site Assessment (HSA) was prepared by HydroGeoLogic, Inc. (HGL) as one of a series of tasks assigned by the U.S. Environmental Protection Agency (EPA) for conducting a radiological characterization study within the area of the Santa Susana Field Laboratory (SSFL) known as Area IV and the Northern Buffer Zone (NBZ). This combined study area is hereafter called the "Area IV Study".

EPA's study consisted of an HSA, gamma scanning of accessible areas, geophysical surveys, and evaluation of past soil sampling results. The HSA therefore provides one line of evidence to be used along with the gamma scanning, geophysical surveys, and results of past soil analyses in EPA's overall Area IV Study.

The objective of the HSA component of the radiological study was to provide a comprehensive investigation that identifies, collects, organizes, and evaluates historical information relevant to nuclear research operations as it pertains to radiological contamination in the Area IV Study Area. Once these areas were identified, potential areas where radiological contamination may exist at the site were identified for sampling.

EPA's Area IV Study was divided into nine subareas, which were addressed in seven Technical Memoranda (TMs). Historical aerial photographic analysis and process history obtained from former employee interviews were also considered during this study. The comprehensive HSA is presented in a series of eight volumes on eight compact discs (CDs) as follows:

- Volume I: Final Historical Site Assessment
  - Appendix A: Aerial Photographic Analysis
  - Appendix B: Final Former Employee Interview Report
- Volume II: Final Technical Memorandum, Subarea HSA-5A
- Volume III: Final Technical Memorandum, Subarea HSA-5B
- Volume IV: Final Technical Memorandum, Subarea HSA-5C
- Volume V: Final Technical Memorandum, Subarea HSA-5D
- Volume VI: Final Technical Memorandum, Subarea HSA-6
- Volume VII: Final Technical Memorandum, Subarea HSA-7/3/NBZ
- Volume VIII: Final Technical Memorandum, Subarea HSA-8

1.1 EPA HSA Process Overview

The following sections provide an overview of the overall HSA process implemented at the SSFL Area IV Study area.

1.1.1 HSA Preparation

The overall HSA process for the Area IV study area included development of the following distinct reports, which were produced independently and then integrated in eight volumes into this single, combined HSA:

- Final HSA, which includes an overview of the HSA process employed at the site.
- Aerial Photographic Analysis of Santa Susana Field Laboratory, Area IV, Ventura County, California, March 2010.
- Final Former Employee Interview Report, Santa Susana Field Laboratory Site, Area IV Radiological Study, Ventura County, California, February 2012.
- Seven Final TMs, which pertain to the nine subareas comprising the Area IV Study area.

In order to facilitate rapid communication of HSA findings to the HGL field teams, while also ensuring that the project's stakeholders had the opportunity to provide insight and comments to the process, the TMs were completed using an ongoing schedule. Thus the findings of each TM could be rolled out for field team use in determining sampling locations while completion of other TMs continued.

The development of the seven TMs served as the primary basis for valuable SSFL stakeholder involvement and participation in planning the Area IV radiological investigation. The process of preparing draft TMs, soliciting stakeholder comments, presenting findings at stakeholder meetings, preparing responses to stakeholder comments, and preparing final versions of each TM has ensured that this final HSA is as complete as possible in addressing stakeholder concerns at the site.

Each TM provided recommended locations for soil/sediment sampling based on an evaluation of the information obtained for each subarea discussed. These recommendations were based solely on historical information and not on-the-ground evaluation. Rather, the TM recommendations were analyzed by field personnel who would be engaged in gamma scanning, geophysical surveys, and soil and water testing.

The stakeholders were also engaged in the process of analyzing HSA recommendations and determining appropriate sampling locations at two points in the information analysis process. First, stakeholders participated in general public visits to the site, normally held once or twice a month. During these visits, the stakeholders viewed the sites identified in the TMs and discussed them with field personnel. Second, during stakeholder technical meetings, the stakeholders and field personnel discussed and decided upon specific sampling points. Thus the stakeholders were able to actively work with EPA to determine the best possible sampling locations to ensure a complete radiological study. The methodology for determining sampling locations, as well as the findings of the various field investigation efforts, are presented in separate reports of findings.

The HSA and the Former Employee Interview Report, presented in Volume I, were prepared by HGL on behalf of EPA. The Aerial Photographic Analysis, also presented in Volume I, was prepared by EPA. The TMs, presented in Volumes II through VIII, were prepared by HGL on behalf of EPA.

The HGL HSA team consisted of four staff members: a team leader and three primary authors. Each primary author was assisted on a rotational basis, when possible, by other members of the HSA team. After a TM was submitted for stakeholder review, that TM's primary author was then assigned either to another TM or to assist another primary author with their assigned TM. Together, the HSA team represented nearly 55 years of experience at HGL performing environmental research and investigations. Therefore, a relatively small HSA team was utilized. The HGL HSA team worked under the direction and oversight of several HGL senior technical staff members, as well as EPA senior technical staff members and project managers.

The HGL HSA team leader was Mr. Eric Dambaugh. The three primary HGL HSA authors were as follows:

- Ms. Jessica Berg: HSA-5A and HSA-5D TMs.
- Ms. Kimberly Clower: HSA-5B and HSA-7/3/NBZ TMs; Former Employee Interview Report.
- Ms. Victoria Guvanasen: HSA-5C, HSA-6, and HSA-8 TMs.

The content of each TM was based on guidance provided in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM, Revision 1, August 2000). MARSSIM is used as an investigative tool used to gain an understanding of the nature and extent of radiological contamination left at a site. The TMs provide preliminary recommendations for MARSSIM classifications based solely on historical information that may be updated once additional information is available pertaining to the presence of radiological contamination at these various areas and facilities within Area IV.

Each of the seven TMs presents a summary of the identified environmental concerns associated with past radiological operations within the Area IV Study portion of the SSFL site, which consists of four areas: Areas I, II, III, and IV; and two buffer zones: the NBZ and the Southern Buffer Zone (SBZ). With the exception of 452 acres owned by the U.S. Government in Areas I and II, which are outside of the Area IV Study area, the entire SSFL site, including the NBZ, is owned and operated by the Boeing Company.

EPA divided the Area IV Study Area into subareas, which were addressed in the following TMs: HSA-5A, HSA-5B, HSA-5C, HSA-5D, HSA-6, HSA-7/3/NBZ, and HSA-8.

1.1.2 Technical Memorandum (TM) Contributions to Sampling Approach

Preliminary findings based on historical documentation only (i.e., before EPA's field investigation activities) were presented in the TMs and include:

- Descriptions and locations of potential, likely, or known activities that involved radioactive material, radioactive waste, or mixed waste;
- Initial MARSSIM classifications (e.g., Class 1, 2, 3) of potentially impacted areas;
- A site-by-site assessment of the likelihood or "weight of evidence" of radiologically contaminated media;
- An assessment of the likelihood of potential migration pathways; and,
- Identification of, confirmation of, and, if appropriate, addition or subtraction to, the list of the potential radiological contaminants of concern.

The information provided in each TM together with comments and recommendations provided by SSFL stakeholders and the general public was used in the EPA's investigation strategy for sampling and analysis for residual radiological contamination in surface and subsurface soil within each subarea.

Each TM (found in Volumes II through VIII of this HSA) presents findings relative to the above-stated criteria. Nuclear facilities at the U.S. Department of Energy's (DOE) Energy Technology Engineering Center (ETEC), parts of which were located within subareas HSA-5A, HSA-5B, HSA-5C, HSA-6, HSA-7, and HSA-8, included 10 nuclear research reactors over the period July 1956 through February 1980. These research reactors are listed in Table 1.1, below, and depicted on Plate 1.

Table 1.1
Research Reactors Located at the Santa Susana Field Laboratory[1]

Reactor Acronym	Building No.	Facility Name	Power Level (kW)	Period of Operation	Power Generated (MWd)	Radioactivity at End of Operation (10^3 Ci)
KEWB	4073	Kinetics Experiment Water Boiler	1	7/1956 to 11/1966	1	6
L-85/AE-6	4093	L-85 Nuclear Experimentation Reactor	3	11/1956 to 2/1980	2	18
SRE	4143	Sodium Reactor Experiment	20,000	4/1957 to 2/1964	6,700	120,000
SER	4010	Systems for Nuclear Auxiliary Power (SNAP) Experimental Reactor Facility	50	9/1959 to 12/1960	13	300
S2DR	4024	SNAP Environmental Test Facility	65	4/1961 to 12/1962	13	390
STR	4028	Shield Test Irradiation Facility	50	12/1961 to 7/1964	1	300
S8ER	4010	S8ER Test Facility	600	5/1963 to 4/1965	215	3,600
STIR	4028	Shield Test Irradiation Facility	1,000	8/1964 to /1974	28	3,714
S10FS3	4024	SNAP Environmental Test Facility	37	1/1965 to 3/1966	16	6,000
S8DR	4059	SNAP Development Reactor Facility	619	5/1968 to 12/1969	182	220

Seven criticality test facilities (i.e., facilities housing operations involving masses of fissionable material capable of sustaining a nuclear chain reaction) were also located on Area IV.[2] These are listed in Table 1.2, below, and on Plate 1. Other nuclear facilities within Area IV, in subareas HSA-7/3/NBZ, HSA-5D, and HSA-8, respectively, included the Radioactive Materials Disposal Facility (Building 4021), the Hot Laboratory (Building 4020), and the Sodium Disposal Facility, or Area IV burn pit, (Building 4886). Each of these facilities is addressed as a site within the appropriate TM along with supporting buildings and open areas.

[1] Oldenkamp, R.D. and Mills, J. C., *Nuclear Operations at Rockwell's Santa Susana Field Laboratory – A Factual Perspective*, Rockwell International; Report No. N001ER000017, September 6, 1991, p. 23.
[2] Atomics International, A Division of North American Aviation, Inc., *Atomics International,* December 1959

Table 1.2
Criticality Test Facilities at the Santa Susana Field Laboratory[3]

Facility Name	Building No.	Period of Operation	Notes
SNAP Critical Test	4373	1957 to 1963	First SNAP-2 criticality tests
Organic Moderated Reactor	4009	1958 to 1967	Basic tests of reactor concept
Sodium Graphite Reactor	4009	1958 to 1967	Basic tests of reactor concept
SNAP Critical Equipment	4012	1961 to 1971	Later SNAP criticality tests
Fast Critical Experiment	4100	1961 to 1972	Started as Advanced Epithermal Thorium Reactor (AETR)
SNAP Flight Systems	4019	1962	SNAP flight system criticality
SNAP Transient Test	4024	1967 to 1969	SNAP transient response tests

1.1.3 TM Site Summary Methodology

In preparing the TMs, the following types of documents and information sources were reviewed:

- radiological characterization reports;
- previous radiological surveys;
- D&D reports;
- environmental monitoring reports;
- license termination reports;
- aerial photographs dating back 50 years;
- building floor plans;
- piping diagrams and construction drawings;
- RFI reports;
- unusual occurrence reports;
- incident reports;
- plant operating reports and logs;
- safety analyses reports;
- facility surveillance and maintenance reports; and
- information obtained from interviews with former workers or other persons.

Numerous documents were obtained through information requests sent to Boeing, DOE, and other parties including the National Aeronautics and Space Administration (NASA). EPA sent formal information requests to Boeing, DOE, the Nuclear Regulatory Commission (NRC) and the California Department of Public Health (CDPH) under § 104(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In addition, EPA directed Boeing to identify and provide pertinent documents within a number of document databases comprising approximately 1.4 million documents relating to all areas of the SSFL site, including Area IV, as well as some off-site facilities.

[3] Oldenkamp, R.D. and Mills, J. C., *Nuclear Operations at Rockwell's Santa Susana Field Laboratory – A Factual Perspective*, Rockwell International; Report No. N001ER000017, September 6, 1991, p. 25.

Additional details regarding the execution of these information requests can be found in each TM (Volumes II through VIII of this HSA).

1.1.4 TMs and the Radiological HSA

The subject areas considered and addressed for each site discussed in Section 2 of each TM are presented below. For each subject area, the list of criteria evaluated and the associated parameters for the evaluation are described. The most complete available information was used to evaluate the site; no known information was omitted from the description. In the event that known information did not conform to one of the listed subject areas, it was included in the most logical place.

Site Description
A physical description of the site including, at a minimum, the following data elements: building numbers of all buildings within the site; date of construction of building(s); buildings in the vicinity not associated with the site; location of site relative to street(s); site plan(s); and floor plan(s) from as-built or plan drawings, if available.

Building Features
Information related to dimensions or size of building(s), below-ground structures, vaults, pipelines, sumps, condensation lines, sewers, drains, swales, and leach fields. If none of these features were identified, the text "no information was located" was inserted.

Former Use(s)
Details of past use(s) of the site, including dates of activities.

Information from Interviewee(s)
This category includes information about the site provided by interviewee(s). If no information was obtained for a particular site, the text "none to date" was inserted. Individuals who have been interviewed include:

- Former SSFL Employees (e.g., health physicists, electricians, mechanics, construction inspectors, nuclear technicians, etc.);
- Survivors of Former Employees;
- Former Contractors (and one survivor of a former Contractor);
- Community Stakeholders; and
- Residents in surrounding areas.

At the discretion of the Interviewee, each interview is conducted either by representatives of the EPA only, representatives of the DOE only, or jointly by EPA and DOE representatives. EPA's primary objective of the interview program was to help direct the soil sampling crews to potential source areas of radiological contamination identified during the course of each interview. All information on potential source areas, corroborated or not, was recorded in EPA's HSA process.

Details regarding the interviews conducted by EPA are presented in Appendix B (found in Volume I) of this HSA.

Radiological Incident Reports
Reports on any documented incidents at the site with the potential for release of radioactivity into the environment. If no incident reports were found, the text "none found" was inserted.

Current Use
Current use of the site, or date of demolition of building/structure.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s)
Previous radiological investigations such as surveys, decontamination activities, and cleanup activities were evaluated. The evaluation of previous investigations and cleanups addressed, at a minimum, the following elements:

- agency conducting the investigation;
- purpose of the investigation;
- dates of the investigation;
- details of releases inside building, to air, to soil, and to surface water, as applicable;
- decontamination/cleanup activities; and
- final survey results.

Radiological Use Authorizations
Use authorizations have been defined as issuance of a license for radioactive material(s) from an appropriate regulatory agency. All known licenses issued for the site were included; if none were found, the text "none found" was inserted.

Former Radiological Burial or Disposal Locations
A description of known burials and/or disposals of radiological materials on the site, including applicable dates, if known. If no documented burials and/or disposals were identified, the text "none found" was inserted.

Aerial Photographs
The applicable photographic analyses from the report prepared by the EPA's Environmental Photographic Interpretation Center (EPIC) in March 2010 were included for each site. These analyses include photographs from the following dates:

- December 22, 1952;
- August 19, 1957;
- August 21, 1959;
- Approximately 1960 plus or minus a year;
- March 1, 1965;
- August 13, 1967;
- April 20, 1972;
- May 16, 1978;
- October 21, 1980;

- August 21, 1983;
- October 10, 1988;
- June 19, 1995; and
- June 8, 2005.

Aerial photograph anomalies were interpreted as a trigger for assigning a higher scrutiny to a particular site than other information (such as historical documents) would indicate.

Details regarding EPA's aerial photographic analysis can be found in Appendix A (found in Volume I) of this HSA.

Radionuclides of Concern
Radionuclides used/generated at the site. This description includes, at a minimum, the types of radiological material(s) managed at the site; radionuclides known or suspected to have been handled or generated on the site; and how the identified radionuclides impact the list of radionuclides of concern in the background study. If no information was available, the text "none found" was inserted. It is important to note that not every radionuclide listed in this HSA will have a sample analysis. The radionuclides are listed for completeness, indicating that they have been mentioned or discussed in a cited document or report. However, many of the facility and site reports reflect the conditions at the time, thus every mention of a specific radionuclide does not mean it would be present now, due to decay. For this reason, the Radionuclides of Concern sections described for each facility or site list those found in historical records. The Radionuclides of Concern tables list radionuclides that will be analyzed and does not include those that would have decayed in the years since operations ceased.

Drainage Pathways
This category includes information on the direction of surface water flow on the site and the presence of sanitary drains, storm drains, channels/ditches, septic systems, or leach fields on or near the site.

Radiological Contamination Potential
The potential for radiological contamination was evaluated for each site. Evaluations included consideration of the completeness of past cleanup and remedial operations. Many past clean-up efforts likely did not achieve the requirements of the California Department of Toxic Substances Control (DTSC)/DOE AOC dated December 2010 that generally requires a cleanup to background levels for both radiological and chemical contaminants. Background studies for the site were completed with EPA leading the radiological background study and the DTSC leading the chemical background study. The potential for radiological contamination is quantified in the TMs by assigning a preliminary MARSSIM class describing the possibility for residual radiological contamination at the site based on all information collected to date. The basis for assigning the preliminary MARSSIM classification includes an examination of the following data elements:

- historical site operations;
- previous radiological investigations;
- reported incidents of releases;
- decontamination and remediation operations at the site;

- interviews with former workers;
- drainage pathways on or near the site;
- aerial photograph interpretation; and
- site reconnaissance.

1.1.5 HSA Goals and Methodology

As previously stated, the objective of the HSA component of the radiological study was to provide a comprehensive investigation that identifies, organizes, and evaluates historical information relevant to nuclear research operations as it pertains to radiological contamination in the Area IV Study area. Once these areas were identified, potential areas where radiological contamination may exist were identified for sampling.

Each TM provided recommended locations for soil/sediment sampling based on an evaluation of the information obtained for each subject area discussed. The criteria evaluated are presented below. These recommendations were analyzed by EPA field personnel who would be engaged in gamma scanning, geophysical surveys, and soil and water testing. As an integral part of the process of choosing sampling locations, field personnel, along with several stakeholders who participated in numerous site reconnaissance and planning meetings, used the TM recommendations to determine the best possible sampling locations to ensure a complete radiological study.

Recommended Locations for Soil/Sediment Sampling
For each site, recommendations were made for possible targeted soil/sediment sampling locations. The selection of potential sampling locations was based on locations with the highest potential for radiological contamination as well as at the particular site based on all known information collected to date. The criteria evaluated for developing recommended soil/sediment sampling locations include the following:

- topography of the site;
- historical site operations;
- radiological investigations;
- reported incidents of releases;
- decontamination/cleanup operations at the site;
- interviews with former workers;
- storm drains on or near the site;
- sewer lines on or near the site;
- aerial photograph interpretation; and
- site reconnaissance.

1.2 TM Key Findings Pertaining to Sampling Approach

The key findings of each TM as they pertain to determining appropriate sampling locations are depicted on each of the plates corresponding to the nine subareas within the Area IV Study Area.

These plates are presented in the seven TMs that address the nine subareas (Volumes II through VIII of this HSA).

The annotations on these plates, as well as the recommendations for soil/sediment sampling made that the end of the discussion of each site, were analyzed by EPA field personnel who would be engaged in gamma scanning, geophysical surveys, and soil and water testing, as well as numerous stakeholders who participated in site reconnaissance and planning meetings.

A summary of the key findings as presented in each TM's respective plates is as follows:

1.2.1 HSA-5A

Building 4024

Plate 1 and Figure 2.1 of the HSA-5A TM (found in Volume II of this HSA) provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4024 area. There were radiological incidents at Building 4024 and documented evidence of radiological releases. Significant information is lacking regarding the excavation activities at Building 4024.

In addition, previous characterization studies for the Building 4024 area were focused on delineating the extent of contamination to standards that were applicable at the time. Therefore, additional characterization is recommended for the Building 4024 area. This includes the following Building 4024 areas and appurtenances:

- The locations of the two August 1996 Area IV Radiological Characterization Survey samples northeast of Building 4024 and west of Building 4024 in a dirt area. Elevated soil activity was located in Sample ID 95-0105 located northeast of Building 4024 where Cs-137 measured at 0.37 pCi/g. Sample ID 95-0106 also contained Cs-137 at 0.34 pCi/g and was located west of Building 4024 in a dirt area.[4]
- The location of the gas holdup tanks and liquid waste tanks. Interviewee 255 made reference to the removal of tanks that were "potentially holding radioactive gases at one time"; however, it is unclear whether the tanks being referred to include those identified as possible sampling locations.
- The outside storage area west of Building 4024. In 1967 and 1972, an open storage area is visible just west of Building 4024 with drainage trending west, southwest. The open storage area is no longer present in 1978 and the drainage channel has been replaced by an escarpment. In 1980, the open storage area west of the building has returned and dark-toned material is visible at the southeast corner of the building. Possible leakage is visible on the west side of the building in the 1983 aerial photographs. In 1988, an open storage area is again present on the west side of the building but is no longer visible in 1995.[5]

[4] Rocketdyne, A4CM-ZR-0011, Area IV Radiological Characterization Survey, Final Report, Volume I, August 15, 1996. pgs. 39, 108, 109.
[5] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

- The Cooling Tower 4928 sump and the footprint of Site 4927 (nitrogen storage tank) should be sampled due to limited information on cooling tower operation and sump use during building operations.
- The area east of the building where reactors were brought in and removed from the facility. This area also includes the waste storage tanks. Below-ground radioactive waste storage facilities are located under asphalt in the yard. The buried tanks include three radioactive gas holdup tanks 6 feet in diameter and 40 feet long, eight solid radioactive waste storage vaults 3 feet in diameter and 4 feet deep, and two liquid radioactive waste holdup tanks. These tanks were placed on top of a concrete box filled with gravel designed to contain any accidental leakage.[6,7]
- The former location of the apparent leakage of an unknown container at Building 4024 that appears to leak north-northeast toward the northwest corner of Building 4027 in 1980 aerial photographs. In the 1983 aerial photographs two possible stains are visible on the northeast corner of the building where the previous probable container leakage had been visible.[8]

Building 4073

Plate 1 and Figure 2.1 provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4073 area. Previous investigation found radiological contamination in Building 4073. In addition, previous characterization studies for the Building 4073 area were focused on delineating the extent of contamination to standards that were applicable at the time. Therefore, additional characterization is recommended for the Building 4073 area. This includes the following Building 4073 areas and appurtenances:

- The former locations of the underground storage tanks and their drain lines associated with building operations. Located west of Building 4073, the tanks comprised three underground tanks and a 60-foot exhaust stack with a 2,000-cubic foot per minute blower system. A 300-gallon collection tank was used to collect gas directly from the reactor system. A 1,000-gallon storage tank buried beneath floor level and adjacent to the test building retained all liquid waste from the facility. The tank was equipped with pump-out connections for removal of the liquid waste when necessary. Another 1,000-gallon tank was originally used to retain the reactor cooling water so that it could be checked for activity prior to release. That tank appears to have drained through a 2-inch line to the west and then south of the KEWB facility.[9,10,11] Removal of the tanks and lines, as well as their operation, may have left residual contamination above background values in the area.

[6] Atomics International Document, N704FDP990006 Rev. A., "Building T024 (SETF) Facilities Dismantling Plan," July 31, 1981.
[7] Remley, M.E., Atomics International, Letter Re: Comments on Draft Reactor Safety Survey Report for Building 024, July 21, 1965.
[8] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[9] Rockwell International Report, AI-ERDA-13159, "KEWB Facilities Decontamination and Disposition Final Report," February 25, 1976.
[10] Flora, J.W., Atomics International, *KEWB Radiological Emergency Plan*, January 14, 1960. HDMSP01637672
[11] Atomics International, FDP-704-990-002, *Dismantling Plan for KEWB Facility (Bldgs 073,123 and 793)*, October 17, 1974.

- The former Building 4073 footprint. Asphalt and concrete from decontamination and decommissioning (D&D) activities were used as backfill at the site in 1975. While the concrete was decontaminated to levels presented above that were defined "as low as practicable" in 1975, these levels are not in compliance with the requirements of the Administrative Order on Consent (AOC). These samples should be taken at depths greater than 6 feet below ground surface.
- The ditch adjacent to the former dirt road. The ditch leads to 12th Street where the flow of drainage proceeds southeast along 12th Street to G Street and continues southwest to 17th Street.[12] . If radioactive materials were released the ground surface near Building 4073, residual contamination above background values may exist in the materials surrounding the ditch.

Building 4093

Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4093 area. Building 4093 served as the AE-6 and L-85 reactor facility. Consequently, potential radioactive material migration via surface water flow or airborne release from this facility may affect the Building 4093 area. Previous characterization studies for the Building 4093 area were focused on delineating the extent of contamination to standards that were applicable at the time. Therefore, additional characterization is recommended for the Building 4093 area. This includes the following Building 4093 areas:

- The location of the sanitary leach field. Building 4093 was connected to a sanitary leach field that was removed in 1999.[13] If radioactive materials were released into the septic system, residual contamination above background values may exist in the materials surrounding the former leach field. The sampling should include the former location of the 4-inch diameter clay pipe supplying the leach field at a depth of approximately 4 feet below ground surface.[14] The leach field was reported to comprise 234 total linear feet, receiving flow from a 750-gallon septic tank associated with Building 4093. The leach field was located approximately 100 feet south of Building 4093.[15]
- The former location of the 4-inch vitrified clay pipe leading from the west corner of the building to the sanitary sewer. It is possible this line is part of the line that led to the former leach field. If radioactive materials were released into the septic system, residual contamination above background values may exist in the materials surrounding the former pipe.
- The drainage area on the northeast side of the building. Surface drainage extends from the northeast side of the building next to the retaining wall to southeast and then flows southwest toward the paved area southwest of the building.[16] If radioactive materials

[12] Atomics International, Drawing 303-00C-C2, "Misc. Paving, Patching & Drainage Improvements – KEWB," Date illegible, circa 1969. HDMSE00457545.
[13] Boeing Radiation Survey Reports, L-85 Facility Septic Tank Area, July and September 1999.
[14] Rockwell International, *Area IV Radiological Characterization Survey, Final Report, Volume 1*, A4CM-ZR-0011, August 15, 1996.
[15] MWH, *DOE Leach fields (Area IV AOC) RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Draft*, October 2003.
[16] Atomics International, Santa Susana Facility Plot Plan, Drawing 303-GEN-C38, Sheet 4 of 14, June 4, 1964.

were released to surface at or around Building 4093, residual contamination above background values may exist in the soils surrounding the surface drainage areas within the Building 4093 area.

- The east side of the building where gamma radiation was found to be 1,000 milli roentgens per hour (mR/hr) on the east side of the building directly opposite the core. In order to determine the need for access restrictions in the area surrounding Building 4093, a radiation survey of the perimeter of the AE-6 reactor was conducted on August 13, 1970. The reactor was at a power level of 2 kW, and was operating with the shield doors on the east side open and a plastic Lucite rod, approximately 6 feet long, inserted in the one-inch diameter beam hole. Gamma radiation measured 1,000 mR/hr on the east side of the building directly opposite the core.[17] The research team has been unable to determine if the building operated with the shield doors open frequently. If the shield doors were opened frequently during reactor operations, it is possible that residual contamination above background values may exist on the east side of the former building.
- The location of the former 750-gallon septic tank. If radioactive materials were released into the septic system, residual contamination above background values may exist in materials surrounding the former septic tank.

1.2.2 HSA-5B

Building 4010

Plate 1 and Figure 2.1 of the HSA-5B TM (found in Volume II of this HSA) provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4010 area. There were several radiological incidents at Building 4010 and documented evidence of radiological releases. Significant information is lacking regarding the excavation activities at Building 4010. In addition, previous characterization studies for the Building 4010 area were focused on delineating the extent of contamination to standards that were applicable at the time. Previous characterization studies for the Building 4010 area were focused on delineating the extent of contamination to standards that were applicable at the time and not to the standard required by the December 2010 AOC. Therefore, additional characterization is recommended for the Building 4010 area. This includes the following Building 4010 areas and appurtenances:

- Former vault locations in the southern portion of the Building 4010 footprint. Leaks in the reactor and shield cooling lines may have left residual contamination in the area.
- Former radioactive gas holdup tank location exterior and northeast of the Building 4010 footprint. The known radioactive waste holdup tank may have left residual contamination in the area.
- Former septic tank location presumably located west of the Building 4010 footprint. If radioactive materials were released into the septic system, residual contamination may exist in the materials surrounding the former septic tank.
- Former leach field located west of the Building 4010 footprint. If radioactive materials were released into the septic system, residual contamination exist in the materials surrounding the former leach field.

[17] Johnson, B.I., Internal Letter Re: Radiation Survey of the AE-6 Reactor, Building 093, August 13, 1970.

- Former pipewell sump located east of the Building 4010 footprint. Groundwater for the entire Building 4010 vault complex drained into a pipewell sump where it could be monitored. Leaks in the reactor and shield cooling lines may have left residual contamination in the area.
- Former UST located at north corner of the Building 4010 footprint. It is possible that this tank contained radioactive material and left residual contamination in the area.
- Sewer lines located north and west of the Building 4010 footprint. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.
- Drainage area east of Building 4010 depicted in aerial photograph from OS-2 in Subarea HSA-7 to former Building 4010 location. If radioactive materials were released from OS-2 and drained into the Building 4010 area, residual contamination may exist to the east of the building.
- Drainage pathways associated with the Building 4010 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

Building 4012

Plate 1 and Figure 2.1 provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4012 area. Previous investigation found radiological contamination in Building 4012 and significant information is lacking regarding the excavation activities at Building 4012. In addition, previous characterization studies for the Building 4012 area were focused on delineating the extent of contamination to standards that were applicable at the time and not to the standard required by the December 2010 AOC. Therefore, additional characterization is recommended for the Building 4012 area. This includes the following Building 4012 areas and appurtenances:

- Former critical cell (Room 110) and fuel storage room (Room 109) in the northern Building 4012 footprint. Past contamination of these rooms may have left residual contamination in the area.
- Former radioactive waste holdup tank outside Room 104 on the southwest side of the Building 4012 footprint. The known radioactive waste holdup tank may have left residual contamination in the area.
- Sanitary sewer line located south of the Building 4012 footprint. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.
- Former OS-7 (open storage area) and possible WDA-6 (waste disposal area) identified on aerial photographs north of the Building 4012 footprint. If radioactive materials were stored or disposed in OS-7 or WDA-6, contamination could migrate and/or drain into the Building 4010 area, residual contamination may exist to the east of the building footprint.
- Drainage pathways associated with the Building 4012 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

Building 4019

Plate 1 and Figure 2.1 provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4019 area. Previous investigation found radiological contamination in Building 4019 and characterization studies for the Building 4019 area were focused on delineating the extent of contamination to standards that were applicable at the time. Previous characterization studies for the Building 4019 area were focused on delineating the extent of contamination to standards that were applicable at the time and not to the standard required by the December 2010 AOC. Therefore, additional characterization is recommended for the Building 4019 area. This includes the following Building 4019 areas and appurtenances:

- Former test vault location in the central portion of Building 4019. Past use of the vault may have left residual contamination in the area.
- Former waste holdup tank and vault located under Room 107 at south end of Building 4019. The known radioactive waste holdup tank may have left residual contamination in the area.
- Drain and pump locations identified in the as-built plumbing plan of Building 4019. If radioactive materials were released into the building drains, residual contamination may be in the area.
- Sanitary sewer line south of Building 4019. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.
- Storm drainage south of the Building 4019. Storm water originating from Building 4019 discharges into this storm drain. Consequently, this storm drain may provide a pathway for the migration of radionuclides from Building 4019 and residual contamination may be in the area.
- Area north and west of Building 4019 where staining from unknown source was noted in aerial photograph.
- Area between Building 4013 footprint and Building 4019 where leakage from an unknown source was noted in aerial photographs.
- The area between Building 4019 and the Building 4059 footprint. Radionuclides originating from either building may have migrated to the area between buildings via surface water flow or airborne releases.
- Drainage pathways associated with the Building 4019 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

1.2.3 HSA-5C

Building 4059

Plate 1 and Figure 2.1 of the HSA-5C TM (found in Volume IV of this HSA) provide a convenient reference for the following recommendations.

Previous characterization studies for the Building 4059 area were focused on delineating the extent of contamination to standards that were applicable at the time. Therefore, additional characterization is recommended for the Building 4059 area. This includes the following Building 4059 areas and appurtenances:

- The area at the north end of the site where possible open storage was identified in the 1965 aerial photograph. Radionuclides originating from Building 4059 may have migrated to this area via surface water flow or airborne releases.
- The storm drains located on the northwest and southern sides of the site. If radiological materials were released from Building 4059, they may have migrated to the storm drain network during precipitation events.
- The sanitary sewer lines located on the northern and southern sides of the site. If radioactive materials were released into the sanitary sewer system, residual contamination may exist in the materials surrounding the sewer lines.

Building 4100

Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Previous characterization studies for the Building 4100 area were focused on delineating the extent of contamination to standards that were applicable at the time. Therefore, additional characterization is recommended for the Building 4100 area. This includes the following Building 4100 areas and appurtenances:

- The drainage channel surrounding the site may provide a pathway for the migration of radionuclides originating from Building 4100.
- The sanitary sewer lines located on the eastern and southern sides of the site. If radioactive materials were released into the sanitary sewer system, residual contamination may exist in the materials surrounding the sewer lines.
- The septic tank area and associated leach field may contain residual radioactive contamination.
- The Building 4100 storage yard/debris field between Building 4100 and 24th Street has no documented remediation. If radioactive materials were released here, residual contamination may exist in this area.
- The Building 4100 trench may contain residual radioactive contamination because the depth of remediation and backfilling are not documented.
- The areas of the exterior waste storage tank for Building 4100 may contain residual radioactive contamination.

1.2.4 HSA-5D

Building 4020

Plate 1 and Figure 2.2 of the HSA05D TM (found in Volume V of this HSA) provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4020 area. There were numerous radiological incidents at Building 4020 and documented evidence of radiological releases. In addition, previous characterization studies for the Building 4020 area were focused on delineating the extent of contamination to standards that were applicable at the time. Additionally, characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4020 area. This includes the following Building 4020 areas and appurtenances:

- The former Building 4020 footprint is recommended for sampling to characterize the existing fill material and the underlying soil (>18 feet below ground surface). Specifically, sampling locations should be focused to areas with the greatest potential for release such as in the vicinity of former hold up tanks, sumps, and drain lines.
- The former location of the leach field and septic tanks are recommended for sampling.
- The western boundary of the Building 4020 footprint and the boundary of the paved areas to the west of the building are recommended for sampling. These areas were known to be contaminated as a result of the handling of casks and other storage containers that were transported into and out of Building 4020.
- The alignment of the former pipeline leading from the Building 4020 basement through the transfer tunnel to Building 4468 should be sampled for potential residual contamination. Like the Building 4020 footprint, the transfer tunnel was removed during demolition of the building and the area was excavated to a depth of between 10 and 18 feet. The area was subsequently backfilled.
- Aerial photographs indicate the presence of stains at the northwest corner of the Building 4020 area boundary. This area, if not disturbed during demolition activities, may show elevated levels of contamination.
- As a result of documented releases of radioactive materials outside of the building, the drainage channels along G, J, and 24th Streets are recommended for sampling. Surface water run-off from Building 4020 flowed either into the ditch on the south side of G Street or into the ditch on the south side of J Street.
- The former paved areas to the north of the former building are recommended for sampling. As was documented in incident report A0016, on May 31, 1962, a portable radioactive liquid holdup tank was being filled from the radioactive holdup tank inside Building 4020 when the portable tank overflowed and a maximum of 50 gallons of liquid was spilled. The spilled liquid flowed down slope to the road and then to a drainage ditch. A similar incident occurred on November 24, 1964, when a radioactive spill resulting from the overflow of a 500-gallon portable liquid holdup tank occurred in the north loading dock area of Building 4020. A maximum of 25 gallons of liquid was lost at the north loading dock area and resulted in contamination of the immediate area.

Building 4373

Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4373 area. Building 4373 included a SNAP critical assembly (SCA) that had a pseudo spherical shape with a fixed hydrogen moderator, highly enriched U-235 fuel, and a beryllium and graphite reflector.[18]

There were radiological incidents at Building 4055 and documented evidence of radiological releases. Significant information is lacking regarding the excavation activities of the drainage lines leading to the Building 4055 liquid waste holdup system.

In addition, previous characterization studies for the Building 4373 area were focused on delineating the extent of contamination to standards that were applicable at the time. In additional, characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4373 area. This includes the following Building 4373 areas and appurtenances:

- Sampling is recommended in the drainage channels surrounding Building 4373. This includes drainage channels to the north and south of the building. A 1964 plot plan shows a drainage channel located at the northeast corner of the fence boundary that leads north along 22nd Street to the parking lot entrance, flows under the parking lot entrance through an 18-inch corrugated metal pipe, and continues to a catch basin located at the intersection of G Street and 22nd Street. The flow from the catch basin is directed through a 36-inch corrugated metal pipe under 22nd Street and into a natural drainage ditch that flows east-southeast toward Area III. Drainage from the southern portion of the building appears to have been directed to a 24-inch corrugated metal pipe near the southeast corner of the building, under 22nd Street, and eastward along J Street toward Area III.[19]
- Sampling is also recommended at the former Building 4373 leach field located southeast of the building. Limited information regarding the abandonment of the leach field has been located.
- The former Building 4373 footprint is recommended for sampling, including the former location of the SCA.

The underground drainage lines of Building 4055 were located to the west of Building 4373 within the facility's fenced boundary. The sampling of these lines is recommended under Building 4055.

[18] ETEC Document, GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[19] Atomics International, Drawing No. 303-GEN-C41, Sheet 7 of 14, Santa Susana Facility Plot Plan,

1.2.5 HSA-6

Building 4143

Plate 1 and Figure 2.1 of the HSA-6 TM (found in Volume VI of this HSA) provide a convenient reference for the following recommendations.

Previous characterization studies for the Building 4143 area were focused on delineating the extent of contamination to standards that were applicable at the time. Characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4143 area. This includes the following Building 4143 areas and appurtenances:

- The flat and low-lying areas surrounding Building 4143. Radionuclides originating from Building 4143 may have migrated to these areas via surface water flow or airborne releases.
- The northeast corner of Building 4143 where open storage was identified in aerial photographs and where spills occurred from sumps and underground vaults.
- The north side of Building 4143 where approximately 3,550 gallons of water were dumped from two radioactive liquid waste storage tanks in 1964, and another spill occurred in 1977.
- The area of the fuel cleaning cells (also known as wash cells) where an explosion caused damage to system components in June 1959.
- The north and east sides of Building 4143 where possible debris and stains were identified in aerial photographs.
- The former septic tank and leach field area that also serviced Buildings 4003 and 4163. Boeing excavated, removed, and survey these items in 2000, but it is not clear that this area was thoroughly investigated and decontaminated.
- The storm drain system located south of the site that connected to the SRE retention pond. The pond initially drained to the NBZ and Brandeis-Bardin Institute land, but was later connected through an overland pipe to a channel/ditch connecting to the Area II ponds.
- The drainage channel/ditch located north of the site that connected to the SRE retention pond. Accidental spills of contaminated water drained into this channel.
- The sanitary sewer line located east of the site. If radionuclides were released into the sanitary sewer system, residual contamination may exist in the materials surrounding the sewer lines.

1.2.6 HSA-7/3/NBZ

Building 4021

Plate 1 of the HSA-7/3/NBZ TM (found in Volume VII of this HSA) provides a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4021 area. There were several radiological incidents at Building 4021 and documented evidence of radiological releases. Previous characterization studies for the Building 4021 area were focused on delineating the extent of contamination to standards that were applicable at the time and not to the standard required by the December 2010 AOC. Therefore, additional characterization is recommended for the Building 4021 area. This includes the following Building 4021 areas and appurtenances:

- Under the abandoned in place Building 4021 septic tank located below grade north of the asphalt swale. Documented releases to the Radioactive Materials Handling Facility (RMHF) leach field indicate the septic tank may have left residual contamination in the area.
- Under the sumps and floor drains inside Building 4021. The sumps and floor drains carried contaminated waste from the Building 4021 decontamination and packaging rooms. Residual radioactive contamination is likely in this area.
- Under the Building 4021 sump, sump tank (UT-16) and former radioactive liquid storage tank (T-1) located outside and west of the building. These features are considered to be radiologically contaminated, having received contaminated waste from the Building 4021 floor drains and Building 4022 vaults. This area is also the location of a radioactive liquid spill (A0070). Residual radioactive contamination is likely in this area.
- Under the electrical substation sump and drainage discharge point located on the western side of Building 4021. Although the sump and drainage was designed for stormwater, this water could contain airborne contamination and the discharge point may present an area where water can pool. Residual radioactive contamination could be present.
- Under the subsurface pipeline that connects the sump tanks in Building 4021 with the vaults in Building 4022 vaults with the sump tanks in Building 4021. This pipeline carried radioactive liquids. Leaks in the pipeline could have contributed to contamination and the pipeline itself could have provided a pathway for contaminant migration. Residual radioactive contamination is likely in this area.
- Filter/blower area between Building 4021 and Building 4022. This area contained the high-efficiency particulate air (HEPA) filter exhaust system, trenches to drain water from the area, and a below-grade pipeline to the RMHF northern slope. The trenches and pipeline may have also provided pathways for contaminant migration. Residual radioactive contamination is associated with some of these features and may be present in this area.
- Safety shower located on the north central side of Building 4021. The shower could have provided a drainage area for residual contamination.
- Pad and asphalt behind the decontamination room where a radiological incident (A0448) occurred and contaminated the area. Residual contamination may be present.
- Lower parking lot area where contaminated blocks were found according to a radiological incident report (A0680). The contamination was removed at the time of the incident, but residual contamination may still exist.
- Paved area from the former 5,000-gallon radioactive liquid waste storage tank (T-1) to a point 40 yards south and west of the tank and ranging between 2 and 10 feet where a spill of 40 to 50 gallons of contaminated water occurred according to a radiological incident

report (A0070). Contamination from the incident was fixed in place and residual contamination may still exist.

- Possible stained area west of Building 4021 depicted in 1967 aerial photograph. If radioactive materials were spilled in this stained area, residual contamination may be present.
- Aboveground pipeline depicted in aerial photographs from 1967 through 1980 that extends from north end of Building 4021 to the northern perimeter of RMHF site. This pipeline could have leaked radioactively contaminated liquid onto the asphalt below. Residual radioactive material may be present on the ground below the pipeline.
- Area of dark-toned material west of Building 4021 identified in a 1980 aerial photograph. If radioactive materials were spilled in this dark-toned material, residual contamination may be present.
- Under the sewer lines located north and west of Building 4021. If radioactive materials were released into the sewer system, residual contamination may exist in the materials surrounding the sewer lines.
- Surface drainage areas around the Building 4021 area. Radiological incident A0080 noted that contaminated liquid flowed from Building 4021 to the RMHF 4614 Holdup Pond. Any releases of radioactive materials would have followed drainage pathways from the building and could leave residual contamination.

Building 4028

Plate 1 provides a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4028 area. There were several radiological incidents at Building 4028 and documented evidence of radiological releases. Previous characterization studies for the Building 4028 area were focused on delineating the extent of contamination to standards that were applicable at the time and not to the standard required by the December 2010 AOC. Therefore, additional characterization is recommended for the Building 4028 area. This includes the following Building 4028 areas and appurtenances:

- Former reactor, test vault, and fuel storage locations in the west portion of the Building 4028 site. Leaks in the reactor and shield cooling lines may have left residual contamination in the area.
- Former radioactive sink for liquid waste disposal in the east portion of the Building 4028 footprint. The known radioactive sink may have left residual contamination in the area.
- Former holding reservoir [RMHF 4614 Holdup Pond] located at the edge of the asphalt driveway leading to the Building 4028 footprint that accumulated cooling tower water and rainwater. If radioactive materials were released or accumulated in the holding reservoir, residual contamination may be present.
- Former trench outside the reactor room that contained the water purification system and a primary side circulating pump as part of the cooling tower system. The trench could provide a drainage area for surface water and could collect any residual contamination.
- Former sump pump located at the northwest corner of the Building 4028 test vault accessway [RMHF 4614 Holdup Pond pump] that pumped water from the holding

reservoir to Rocketdyne. If radioactive materials were released or accumulated in water, residual contamination may be present.

- Former spill areas on the bank above the former Building 4028 area noted in a 1975 letter. These known areas of contamination were thought to have followed drainage pathways down the bank. Residual contamination may be present.
- Open storage area (OS-13) west of Building 4028 depicted in a 1980 aerial photograph. Possible stains were noted in this area. If radioactive materials were released from OS-13, residual contamination may exist.
- Drainage areas north and south of Building 4028. Aerial photographs and other documents note stormwater drainage pathways on the north and south sides of the building. Residual contamination may exist in these drainages.

1.2.7 HSA-8

Building 4009

Plate 1 and Figure 2.2 of the HSA-8 TM (found on Volume VIII of this HSA) provide a convenient reference for the following recommendations.

Information is lacking regarding the excavation activities for the leach field, hold-up tanks, and septic tanks at Building 4009, particularly in late 1989 and early 1990. The characterization studies for the Building 4009 area were focused on delineating the extent of contamination to previous standards. Characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4009 area. This includes the following Building 4009 areas and appurtenances:

- The flat and low-lying areas surrounding Building 4009, particularly on the north, south and west sides where open storage was identified in aerial photographs. Radionuclides originating from Building 4009 may have migrated to these areas via surface water flow or airborne releases.
- The waste hold-up tank, pit, and septic tank located northwest of the OMR, as shown in Figure 2.2.1d. It is unclear whether this area was thoroughly investigated and decontaminated in 2002.
- The waste hold-up tank, pit, and septic tank located northeast of the SGR, as shown in Figure 2.2.1d. It is unclear whether this area was thoroughly investigated and decontaminated in late 1989 and early 1990.
- The fuel oil tank located on the southeast side of the OMR, as shown in Figure 2.2.1d. It is unclear whether this area was thoroughly investigated and decontaminated in 1998.
- Within and downgradient of the former 6-line 300-linear-foot leach field area and approximately 50-foot drain line located northwest of Building 4009. It is unclear whether this area was thoroughly investigated and decontaminated.
- The liquid collection area identified in the 1980 aerial photograph. A drainage pathway directs liquid north through a vegetated area. This pathway then appears to be blocked by rock outcrops, resulting in a liquid collection area.

- The storm drain located west of the site that extends onto the NBZ and Brandeis-Bardin Institute land. It is unclear whether this storm drain was thoroughly investigated and decontaminated.
- All surface water drainage pathways including the storm water culvert located southeast of Building 4009, which carries water past Building 4100. It is unclear whether these drainage pathways were thoroughly investigated and decontaminated.
- The main sanitary sewer lines located north of Building 4009. If radionuclides were released into the sanitary sewer system, residual contamination may exist in the materials surrounding the sewer lines.

Building 4886

Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Site 4886 area. For many years this was a radiological disposal area, there were several radiological incidents at Site 4886, and documented evidence of radiological releases. In addition, previous characterization studies for the site 4886 area were focused on delineating the extent of contamination to standards that were applicable at the time. Characterization efforts likely did not achieve the requirements of the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Site 4886 area. This includes the following Site 4886 areas and appurtenances:

- The flat land and low lying areas on Site 4886. Radionuclides originating from items of radiologically contaminated equipment disposed of at the site may have been deposited on soil via explosion, wind, and precipitation events. Rockwell reported that material was dispersed onto surrounding land by explosions that extended to Building 4009, so the radius of impact was about 600 feet. The gamma-scan results may prove helpful for selecting soil sampling locations.
- The locations of the former western, lower, and upper ponds and the concrete-lined pit that were notable features of Site 4886.
- The location of the former barrel open storage area in the southwest corner of the site that was identified in the 1978 and 1980 aerial photographs.
- The land on the far west side of the site between two rock ridges. This may have been a dumping area that has not been fully characterized.
- The drainage channels located on the west and south sides of the site that transport surface water northward to the NBZ. If radionuclides were released at the site, they may have migrated to the drainage channels during precipitation events.
- The drainage channels that extend into and traverse the NBZ. If radionuclides were released at the site, they may have migrated outside the SSFL along these drainage channels during precipitation events.

1.3 Radionuclide List to be Used in Soil and Groundwater Sampling

From a review of historical documents and radioactive material licenses issued for the SSFL, all of the radionuclides selected for radiochemical analysis of soil samples are likely to have been used or generated on the SSFL. Table 1.3, below, presents a summary of potential radiological contaminants of concern for each subarea of the Area IV Study area. Certain radionuclides mentioned in source documents, and thus included in Table 1.3, will not be analyzed. These have undergone radioactive decay in excess of 10 half-lives, such that they could no longer be present. These radionuclides include: Na-22, Fe-55, Sb-125, Cs-134, Ce-144, and Po-210. The September 23, 2010, Stakeholder Technical Meeting Action Items Memorandum describes the radionuclides contained in soil analytical suites, the sample analytical approach, and provides explanations for deleting certain radionuclides from analysis.

Table 1.3a
Summary of Subarea HSA-5A Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4005	Uranium Carbide Fuel Pilot Plant	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238, U-234, U-235), activation products (iron-59 (Fe-59), cobalt-60 (Co-60)), isotopes of thorium (Th-231, Th-234), carbon-14 (C-14), manganese-54 (Mn-54), sulfur-35 (S-35), phosphorous-32 (P-32).	1
4023	Liquid Metals Component Test Building	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-234, U-238 and U-235), isotopes of thorium (Th-228, TH-232), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241, Pu-242), Ne-237, Am-241, fission products (Cs-134, Cs-137, Sr-90), and activation products (Co-60, Fe-55, Eu-152, Eu-154, Ni-59, Ni-63, Ta-182, Mn-54).	1
4024	SNAP Environmental Test Facility	Partially Standing	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235), isotopes of thorium (Th-232), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241, Pu-242), Am-241, fission products (Cs-137, Sr-90), and activation products (Co-60, H-3, Fe-55, Eu-152, Eu-154, Ni-59, Ni-63, Mn-54), K-40, Na-22.	1
4027	SNAP Engineering Development Laboratory	Demolished	Radionuclides of concern include all radionuclides that are included in the background study plus any additional radionuclides identified during the HSA.	2
4029	Radiation Measurement Facility	Standing	Potential radioactive contaminants include fission products (Cs-137) and activation products (Co-60), Ra-226	1
4030/ 4035	AE-6 Counting Room and Workshop	Demolished	Potential radioactive contaminants include H-3.	1
4032	Space Environmental Test Facility	Demolished	Potential radioactive contaminants include activation product Co-60.	2
4036	Non-Nuclear Office Building	Demolished	None specifically identified; however, direct radiation and skyshine from RMHF may affect ambient radiation conditions in the area.	1
4042	SNAP Shield Casting Facility	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235).	1
4046	Material Office Annex	Demolished	None specifically identified.	2
4048	Plant Development Unit Instrumentation Building	Demolished	None specifically identified.	1
4049	Hydraulic Test Control Center	Demolished	Potential radioactive contaminants include activation products (Co-60, Mn-54, Ni-59, Ni-63, Fe-55, Fe-59), C-14, S-35, P-32.	1

Table 1.3a (continued)
Summary of Subarea HSA-5A Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4073	Kinetic Experiment Water Boiler Reactor	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235), fission products (Cs-137, Sr-90), and activation products (Co-60, Eu-152, Eu-154).	1
4074	Storage and Film Processing Building	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235), fission products (Cs-137, Sr-90), and activation products (Co-60, Eu-152, Eu-154).	1
4083/ 4103	Control Building	Demolished	None specifically identified.	1
4093	AE-6 Reactor Building	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235), fission products (Cs-137, Sr-90), and activation products (Co-60, Eu-152, Eu-154).	1
4123	KEWB Waste Storage Building	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235), fission products (Cs-137, Sr-90), and activation products (Co-60, Eu-152, Eu-154).	1
4185	Unknown	Demolished	None specifically identified.	1
4453	Fuel Handling Building	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235), fission products (Cs-137, Sr-90), and activation products (Co-60, Eu-152, Eu-154).	1
4501	Parking Lot	Vegetated	None specifically identified.	2
4536	Parking Lot	Evidence remains	None specifically identified.	2
4633	Reactor Cooling Water Pad	Demolished	None specifically identified.	1
4641	Shipping and Receiving	Demolished	Regulated radioactive material handled in the building; however, a complete list of materials handled in Building 4641 could not be located. As a result, the potential radioactive contaminants include natural and enriched uranium (U-238, U-234, U-235), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), Am-241, fission products (primarily Cs-137, Sr-90), and activation products (H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182).	2
4643	KEWB Exhaust Building	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235), fission products (Cs-137, Sr-90), and activation products (Co-60, Eu-152, Eu-154).	1
4793	KEWB Heating and Air Conditioning	Demolished	Potential radioactive contaminants include natural and enriched uranium (U-238 and U-235), fission products (Cs-137, Sr-90), and activation products (Co-60, Eu-152, Eu-154).	1
4927	Nitrogen Storage Tank	Demolished	None specifically identified.	1

Table 1.3b
Summary of Subarea HSA-5B Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4006	Sodium Laboratory	Standing	Potential radioactive contaminants include: Cs-137, H-3, U-234, U-235, U-238, and UO_2. Radionuclides associated with potential SNAP drainage include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4007	Sodium Storage Building	Demolished	Radionuclides associated with drainage from Buildings 4005, 4006, 4010, 4012, and 4024 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Mn-54, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, U-238, and UO_2.	2
4008	Flammable Material Storage Building	Demolished	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Ir-192, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	2
4010	Systems for Nuclear Auxiliary Power (SNAP) Experimental Reactor (SER), SNAP 8 Experimental Reactor (S8ER)	Demolished	Potential radioactive contaminants include: Sb-125, Am-241, Be-10, Ca-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	1
4011	Administration and Services Building, Development Support Shop, Manufacturing Support Shop, Machine Shop, Radiation Instrument Calibration Laboratory	Standing	Potential radioactive contaminants include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	1
4012	SNAP Critical Test Facility, Heavy Metal Reflected Fast Spectrum Reactor (HMRFSR), Energy Technology Engineering Center (ETEC) X-Ray Facility/Storage	Demolished	Potential radioactive contaminants include: Sb-125, Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	1

Table 1.3b (continued)
Summary of Subarea HSA-5B Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4013	SNAP Non-Nuclear Component Assembly and Performance Test Building, ETEC Thermal Transient Test Facility	Demolished	Radionuclides associated with nearby Buildings 4012 and 4019 include: Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	1
4019	SNAP Flight System Nuclear Qualification Test Building, ETEC Construction Staging and Computer Facility	Standing	Potential radioactive contaminants include: Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	1
4025	Remote Handling Mock-Up Building, ETEC Instrumentation and Inventory Building	Demolished	A potential radioactive contaminant is Co-60. Radionuclides associated with potential drainage from Building 4075 include: isotopes of thorium, plutonium, and uranium, and mixed fission products. Radionuclides associated with nearby Building 4024 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	1
4026	Large Component Test Loop (LCTL) Control Building, Small Component Test Loop (SCTL) Control Building	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4171	X-Ray Building	Demolished	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	1
4172	X-Ray Building	Demolished	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	2

Table 1.3b (continued)
Summary of Subarea HSA-5B Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4226	SCTL Motor Generator Building	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4228	Sodium Component Test Installation (SCTI) Power Pak Building, SCTI Co-Generation Plant	Demolished	Radionuclides associated with Building 4012 include: Sb-125, Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	1
4293	Time Clock	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4310	Portable Change Room	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	1 for original location near SNAP building / 2 for final location near SCTL building
4334	Kalina Cycle Demonstration Power Plant Control Room	Demolished	Radionuclides associated with potential drainage from Building 4019 include: Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	2
4335	Kalina Cycle Demonstration Power Plant Turbine Generator Room	Demolished	Radionuclides associated with potential drainage from Building 4019 include: Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	2
4354	SCTI Control Element Test Structure	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2

Table 1.3b (continued)
Summary of Subarea HSA-5B Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4355	SCTI Control Center	Demolished	Potential radioactive contaminants include Co-60 and Cs-137. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	1
4356	SCTI High Bay	Demolished	A potential radioactive contaminant is Cs-137. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	1
4357	Heat Transfer Loop Control Building, Liquid Metal Engineering Center (LMEC) and ETEC Pump Bearing Test Facility Control Building	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4358	Chemical Storage Building Supporting SCTL, SCTI, and Kalina	Demolished	Radionuclides associated with potential drainage from Buildings 4010, 4012, and 4019 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4359	SCTI Atomizing Air Building	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4360	SCTI Chemical Storage Building	Demolished	Radionuclides associated with potential drainage from Building 4019 include: Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	2
4361	SCTI Hazardous Material Storage Building	Demolished	Radionuclides associated with potential drainage from Building 4019 include: Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	2

Table 1.3b (continued)
Summary of Subarea HSA-5B Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4362	SCTI Water Sampling Building	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4392	SCTI Electrical Equipment Building	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4402	MHD Experiment Building	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4457	SCTI Pump Bearing Test Structure	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4478	SCTI Support Trailer	Demolished	Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4500	Gas Bottle Dock	Demolished	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Ir-192, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	2

Table 1.3b (continued)
Summary of Subarea HSA-5B Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4502	Parking Lot	Demolished	Radionuclides associated with potential drainage from Building 4019 include: Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	2
4506	Parking Lot	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4521	Parking Lot	Demolished	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Ir-192, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	2
4606	Sodium Lab Instrument Building A, MHD Support Building, Hydrogen Recombiner Test Building	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4607	Sodium Lab Instrument Building B	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2

Table 1.3b (continued)
Summary of Subarea HSA-5B Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4611	Paint Spray Booth Canopy	Demolished	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Ir-192, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	2
4612	Maintenance Building	Demolished	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Ir-192, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	2
4615	Combustion Test Facility	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010, 4012, and 4024 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4639	Industrial Engineering Office Trailer Complex	Demolished/ May Not Have Been Built	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Ir-192, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	2
4704	Electrical Substation	Standing	Radionuclides associated with drainage from Buildings 4005, 4006, 4010, 4012, and 4024 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Mn-54, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, U-238, and UO_2.	2

Table 1.3b (continued)
Summary of Subarea HSA-5B Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4714	Power Pak Interconnecting Facility	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
4735	Fuel Tank	Demolished	Radionuclides associated with nearby Building 4011 include: Am-241, Cs-137, Co-60, Eu-152, Eu-154, Ir-192, Pb-210, K-40, Pu-238, Pu-239, Pu-240, Pu-241, Ra-226, Sr-90, Tc-99, Th-230, Th-232, H-3, U-234, U-235, and U-238.	2
4826	Large Component Test Loop Facility	Demolished	Radionuclides associated with nearby Building 4006 include: Cs-137, H-3, U-234, U-235, and U-238. Radionuclides associated with potential drainage from Buildings 4010 and 4012 include: Sb-125, Am-241, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, H-3, U-234, U-235, and U-238.	2
17th Street Drainage	Natural Drainage Area Bermed to Create Holding Pond	Dry, Overgrown	Potential radioactive contaminants include: Am-241, Cs-137, Pu-238, Pu-239, Pu-240, Sr-90, Th-228, Th-230, Th-232, U-234, U-235, U-236, and U-238.	1

Table 1.3c
Summary of Subarea HSA-5C Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4015	Construction Material Storage	Standing	Radionuclides associated with SNAP criticality test Building 4373. Radionuclides associated with Building 4373 will be discussed in TM HSA-5D.	1
4038	SNAP Office Building	Standing	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4039	SNAP Administration Building, LMEC Office Building, Health Physics Counting Laboratory	Demolished	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4057	Launch Handling and Mobile Equipment Development Building, LMEC Laboratory	Boeing Records Room	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4059	SNAP 8 Development Reactor, Large leak Test Rig, Ground Prototype Test Facility	Demolished	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4062	ETEC Instrumentation Operations Building, Storage Facility for Instrument Calibration	Demolished	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4065	SNAP Thermoelectric Converter Test Building, LMEC Chemical Laboratory	Demolished	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4066	Instrumentation Repair and Calibration Building, Instrument Laboratory	Demolished	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4100	AETR, FCEL, Radiation Safety and Computed Tomography	Standing	U-233, U-234, U-235, U-236, U-238, Th-232, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Th-228, Ra-228, Th-230, Ra-226, Pb-210, Pa-231, Ac-227.	1
4383	Instrumentation Building, LMEC Assembly and Test Building	Demolished	U-233, U-234, U-235, U-236, U-238, Th-232, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Th-228, Ra-228, Th-230, Ra-226, Pb-210, Pa-231, Ac-227.	2

Table 1.3c (continued)
Summary of Subarea HSA-5C Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	Preliminary MARSSIM Class
4459	URS Building, ETEC Storage Building	Demolished	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4461	SPTF Motor Generator Building	Demolished	U-233, U-234, U-235, U-236, U-238, Th-232, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Th-228, Ra-228, Th-230, Ra-226, Pb-210, Pa-231, Ac-227.	1
4462	SPTF Building	Awaiting Demolition	U-233, U-234, U-235, U-236, U-238, Th-232, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Th-228, Ra-228, Th-230, Ra-226, Pb-210, Pa-231, Ac-227.	1
4463	Sodium Cleaning and Handling Facility Building	Awaiting Demolition	U-233, U-234, U-235, U-236, U-238, Th-232, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Th-228, Ra-228, Th-230, Ra-226, Pb-210, Pa-231, Ac-227.	1
4482	Government Project Office	Transferred Off Site	U-233, U-234, U-235, U-236, U-238, Th-232, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Th-228, Ra-228, Th-230, Ra-226, Pb-210, Pa-231, Ac-227.	2
4483	LMEC Office Trailer	Transferred Off Site	Radiological contamination is not anticipated in this area.	3
4484	Rest Room Trailer	Transferred Off Site	Radiological contamination is not anticipated in this area.	3
4485	LMEC Office Trailer	Transferred Off Site	Radiological contamination is not anticipated in this area.	3
4486	LMEC Office Trailer	Transferred Off Site	Radiological contamination is not anticipated in this area.	3
4487	ETEC Engineering Building, SHEA Office	Demolished	U-233, U-234, U-235, U-236, U-238, Th-232, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Th-228, Ra-228, Th-230, Ra-226, Pb-210, Pa-231, Ac-227.	2
4538	Parking Lot for Buildings 4482 through 4486	Vegetated Area	Radiological contamination is not anticipated in this area.	3
4626	LMEC Equipment Storage Building, ETEC Inventory Storage Building, SNAP Storage Building	Demolished	U-238, U-234, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cs-137, Sr-90, H-3, Fe-55, Co-58, Co-60, Ni-63, Ba-133, Eu-152, Eu-154, Eu-155, Pm-147, Ta-182.	1
4662	SPTF Small Parts Cleaning Pad	Demolished	U-233, U-234, U-235, U-236, U-238, Th-232, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Th-228, Ra-228, Th-230, Ra-226, Pb-210, Pa-231, Ac-227.	1

Table 1.3d
Summary of Subarea HSA-5D Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4020	Hot Laboratory; Component Development Hot Cell	Demolished	U-235, U-238, Pu-238, Pu-239+240, Th-232, Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, and Tl-208. Also, H-3, Sr-90, Co-60, Cs-137, Eu-152, Am-241, and Am-243. Na-24 has a 15 hour half-life and Co-57 has a 272 d half-life, hence these contaminants have decayed and will not be analyzed.	1
4055	Nuclear Material Development Laboratory	Standing	U-235, U-238, Pu-238, Pu-239+240, Th-232, Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, and Tl-208. Also, H-3, Sr-90, Co-60, Cs-137, Eu-152, Am-241, and Am-243.	1
4173/ 4865	Gammagraph Building	Demolished	Co-60, U-234, U-235, and U-238	2
4353	Organics Reactor Development Building; Research and Development Laboratory Building	Demolished	Co-60, Mn-54, Ni-59, Ni-63, and Fe-55. Mn-54 and Fe-55 have short half-lives and will not be analyzed.	1
4363	Mechanical Component Development and Counting Building; Research and Development Laboratory Building	Demolished	U-235, U-238, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, Tl-208, H-3, Sr-90, Cs-137, Co-60, Eu-152	1
4373	SNAP Critical Facility	Demolished	U-235, U-238, Pu-238, Pu-239+240, Th-232, Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, and Tl-208. Also, H-3, Sr-90, Co-60, Cs-137, Eu-152, Am-241, and Am-243.	1
4374	Test Loop Enclosure	Demolished	U-235, U-238, Pu-238, Pu-239+240, Th-232, Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, and Tl-208. Also, H-3, Sr-90, Co-60, Cs-137, Eu-152, Am-241, and Am-243.	1
4375	Control Shelter Building	Demolished	None identified.	2
4468	Holdup Tank	Demolished	U-235, U-238, Pu-238, Pu-239+240, Th-232, Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, and Tl-208. Also, H-3, Sr-90, Co-60, Cs-137, Eu-152, Am-241, and Am-243.	1
4473	Hydraulic Test Instrumentation Building	Demolished	None identified.	3
4509	Parking Lot	Demolished		2

Table 1.3d (continued)
Summary of Subarea HSA-5D Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4520	Parking Lot	Demolished	U-235, U-238, Pu-238, Pu-239+240, Th-232, Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, and Tl-208. Also, H-3, Sr-90, Co-60, Cs-137, Eu-152, Am-241, and Am-243.	1
4553	Parking Lot	Demolished	None identified.	3
4575	Parking Lot	Demolished	None identified.	3
4701	Water Tank	Demolished	None identified	3
4702	Water Tank	Demolished	None identified	3
4854	Radiation Fuel Gauge Test Structure	Demolished	None identified.	2
4863	Hydraulic Test Loop	Demolished	None identified.	3
4873	Hydraulic Test Laboratory; Fuel Rod Test Tower and Pad	Demolished	None identified.	2
4874	Control Rod Test Tower and Pad	Demolished	None identified.	2
4875	Pad and Creep Loop Tower	Demolished	None identified.	2

Table 1.3e
Summary of Subarea HSA-6 Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4003	Sodium Reactor Experiment (SRE) Support Building, Hot Cave	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Th-228, Th-232, Th-234, H-3, C-14, Ni-59, Ni-63, Co-60, Sr-90, I-129, Cs-137, Eu-152, Ra-226, Ac-228, and Am-241. Radionuclides in prior reports, which will not be analyzed due to decay include Na-22, Sb-125, Cs-134, and Ce-144.	1
4014	Sodium Storage Building	Demolished	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239+240, Th-228, Th-232, Ra-226, Cs-137, Sr-90, H-3, Co-60, Ni-59, Ni-63, Eu-152, Eu-154 and Am-241. Radionuclides in prior reports, which will not be analyzed due to decay include: Na-22, Fe-55, Sb-125, Cs-134, and Ce-144.	2
4040	Contaminated Medical/ Storage Facility	Demolished	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-228, Th-232, Ra-226, Cs-137, Sr-90, H-3, Co-60, Ni-59, Ni-63, Eu-152, and Eu-154.	2
4041	SRE Component Storage, Energy Technology Engineering Center (ETEC) Equipment Storage Building	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4053	Fire Department Service Building	Demolished	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, Sr-90, H-3, Co-60, Eu-152, and Eu-154.	2
4063	Electronics Shop, Maintenance Service Building	Demolished	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, Np-237, Cs-137, Sr-90, H-3, Co-60, Ni-63, Ba-133, Eu-152, and Eu-154.	2
4064	Fuel Element Storage Facility	Demolished	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, Np-237, Cs-137, Sr-90, H-3, Co-60, Ba-133, Eu-152, and Eu-154.	1
4114	Decontamination Trailer	Demolished	U-238, U-234, U-235, U-236, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	2
4143	SRE Reactor Building, ETEC Component Storage	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Np-237, Th-232, H-3, Co-60, Sr-90, Tc-99, I-129, and Cs-137.	1
4153	SRE Sodium Service Building	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4163	SRE Support, Component Equipment Repair Facility (CERF)	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4183	Fire Pump Building	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1

Table 1.3e (continued)
Summary of Subarea HSA-6 Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4184	SRE Battery Room, Diesel Generator Canopy	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4185	Steam Generator Control Building	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4273	Radioactive Laundry	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4283	Radioactive Laundry	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4320	Fuel Oil Control/Pump Building	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4505	Storage Area/Concrete Pad	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4511	Parking Lot at Main Gate	Removed	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	2
4513	Parking Lot between Buildings 4064 and 4030	Removed	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, Np-237, Cs-137, Sr-90, H-3, Co-60, Ba-133, Eu-152, and Eu-154.	2
4540	Parking Lot for Building 4040	Part of G Street	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-228, Th-232, Ra-226, Cs-137, Sr-90, H-3, Co-60, Ni-59, Ni-63, Eu-152, and Eu-154.	2
4583-Old	Old Energy Systems Group (ESG) Salvage Yard (1962-1975)	Removed	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4583-New	New Salvage Yard (1977-1983)	Demolished	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-228, Th-232, Ra-226, Cs-137, Sr-90, H-3, Co-60, Ni-59, Ni-63, Eu-152, and Eu-154.	1
4653	Interim Radioactive Waste Vault	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4684	Steam Generator Pad	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4686	Temporary Hot Waste Storage	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4689	Interim Storage Facility for Contaminated Items from the SRE Complex	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1

Table 1.3e (continued)
Summary of Subarea HSA-6 Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4695	SRE Cold Trap Vault	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4703	Water Tower	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	2
4714	Research and Development Shop Work Area associated with Building 4163	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4723	Steam/Sodium Cleaning Pad associated with the SRE	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4724	Hot Oil Sodium Cleaning Facility for the SRE	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4731	Fuel Oil Storage Tank	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4732	Fuel Oil Storage Tank	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4733	Sodium Cleaning Pad for the SRE Complex	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4743	Tetralin Heat Exchanger for the SRE	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4753	SRE Primary Fill Tank Vault	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1
4773	SRE Waste Water Retention Pond and Dam	Demolished	U-238, U-234, U-235, U-236, Pu-238, Pu-239+240, Am-241, Th-232, H-3, Co-60, Sr-90, and Cs-137.	1

Table 1.3f
Summary of Subarea HSA-7, HSA-3, and NBZ Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4021	Radioactive Material Disposal Facility (RMDF) Waste Decontamination and Packaging ; Radioactive Material Handling Facility (RMHF) Waste Decontamination and Packaging	Standing	Am-241, Co-60, Cs-137, Eu-152, Eu-154, H-3, K-40, Ni-59, Ni-63, Pm-147, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Sr-90, Th-228, Th-232, U-234, U-235, and U-238.	1
4022	RMDF Vault Storage; RMHF Radioactive Vault Storage	Standing	Am-241, Co-60, Cs-137, Eu-152, Eu-154, H-3, K-40, Ni-59, Ni-63, Pm-147, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Sr-90, Th-228, Th-232, U-234, U-235, and U-238.	1
4028	Shield Test Irradiation Reactor (STIR) Facility; Liquid Metal Fast Breeder Reactor (LMFBR) Fuel Safety Building	Demolished	Am-241, Cs-137, Co-60, Eu-152, Eu-154, H-3, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, U-234, U-235, and U-238.	1
4034	RMDF Office Building; RMHF Office Building	Standing	Am-241, Co-60, Cs-137, Eu-152, Eu-154, H-3, K-40, Ni-59, Ni-63, Pm-147, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Sr-90, Th-228, Th-232, U-234, U-235, and U-238.	1
4044	RMDF Clean Shop; RMDF Support Lab; RMDH Support Lab	Standing	Am-241, Bi-210, Co-60, Cs-137, Eu-152, Eu-154, H-3, K-40, Ni-59, Ni-63, Pb-210, Pm-147, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Sr-90, Tc-99, Th-228, Th-232, U-234, U-235, and U-238.	1
4075	RMDF Contaminated Equipment Storage Building	Standing	Uranium, plutonium, thorium, mixed fission products. Isotopes of cobalt and europium.	1
4133	Hazardous Waste Treatment Facility; Hazardous Waste Management Facility	Standing	None identified.	1
4563	Building 4633 Storage Yard; Covered Storage Area Adjacent to Building 4075	Standing	Uranium, plutonium, thorium, and mixed fission products.	1
4614	RMDF Drainage Sump; RMHF Drainage Sump; RMHF Holdup Pond	Standing	Am-241, Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, Th-228, Th-232, U-234, U-235, and U-238.	1
4621	RMDF Equipment Storage Building; RMHF Equipment Storage Building	Standing	Am-241, Bi-210, Co-60, Cs-137, Ir-192, Pb-210, Ra-226, Sr-90, Th-228, and Th-232.	1

Table 1.3f (continued)
Summary of Subarea HSA-7, HSA-3, and NBZ Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4622	RMDF Counting Building	Demolished	None identified. It is presumed that waste handled at other RMHF complex buildings had the potential to be sampled and counted at Building 4622 and thus this building area should be surveyed for the same radionuclides of concern as the rest of the RMHF complex.	1
4654	Interim Storage Facility	Demolished	Uranium and mixed fission and activation products.	1
4658	RMDF Guard Shack; RMHF Guard Shack	Standing	None identified. However, this building was at the entry point for all incoming and outgoing fuel and waste shipments.	1
4663	RMDF Storage Area; RMHF Storage Area	Concrete Pad	Uranium, plutonium, thorium isotopes, and mixed fission products.	1
4664	RMHF Low-Level Waste Processing	Demolished	Uranium, plutonium, thorium isotopes, and mixed fission products.	1
4665	RMDF Oxidation Facility; RMHF Equipment Storage	Standing	Uranium, plutonium, thorium isotopes, and mixed fission products.	1
4688	Auxiliary Skid Shack; RMDF Storage Building; RMHF Storage Building	Standing	Uranium, plutonium, thorium isotopes, and mixed fission products.	1
N/A	RMHF Leach Field	Excavated	Am-241, Co-60, Cs-137, Eu-152, Eu-154, H-3, K-40, Ni-59, Ni-63, Pm-147, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Sr-90, Th-228, Th-232, U-234, U-235, U-238, and Y-90	1
N/A	Southern California Edison Substation	Standing	Am-241, Co-60, Cs-134, Cs-137, H-3, I-129, Pu-239, Pu-240, Pu-241, Pu-242, Sb-125, Sr-90, Th-232, U-234, U-235, and U-238.	2
N/A	Northern Buffer Zone – Northeast Area	No structures	Am-241, Co-60, Cs-134, Cs-137, H-3, I-129, Pu-239, Pu-240, Pu-241, Pu-242, Sb-125, Sr-90, Th-232, U-234, U-235, and U-238.	1
N/A	Northern Buffer Zone – Northwest Area	No structures	Am-241, Co-60, Cs-134, Cs-137, H-3, I-129, Pu-239, Pu-240, Pu-241, Pu-242, Sb-125, Sr-90, Th-232, U-234, U-235, and U-238.	1

Table 1.3g
Summary of Subarea HSA-8 Sites
Potential Radiological Contaminants of Concern

Site No.	Use(s)	Current Status	Potential Radiological Contaminants of Concern	MARSSIM Class
4009	Organic Moderated Reactor Critical Facility, Sodium Graphite Reactor Critical Facility	Standing	U-235, U-238, Th-232, Th-234, Th-228, Ra-226, Ac-228, Pb-214, Pb-212, Tl-208, Bi-214, Bi-212, Sr-90, Cs-137, Na-24, Co-57, Co-60, Eu-152.	1
4056	Landfill	Closed	U-238, U-233, U-234, U-235, U-236, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Am-241, Th-228, Th-232, Ra-226, Cs-134, Cs-137, Sr-90, H-3, Na-22, K-40, Mn-54, Fe-55,Co-58, Co-60, Ni-59, Ni-63, Ba-133, Eu-152, Eu-154, Pm-147, Ta-182.	1
4317/4730	Pistol Range/Isotope System Impact Test Control Building	Demolished	U-238, U-234, U-235, Pa-231, Th-230, Ac-227, Ra-226, Pb-210, H-3, K-40, Mn-54, Fe-55, Co-60, Eu-152, Eu-154.	1
4318/4820	Pistol Range/Isotope System Impact Test Device	Demolished	U-238, U-234, U-235, (Pa-231, Th-230, Ac-227, Ra-226, Pb-210, H-3, K-40, Mn-54, Fe-55, Co-60, Eu-152, Eu-154.	1
4425	Solar Concentrator Test Facility/Weather Station and Astronomical Observatory/Uranium Fuel Element Drop Site	Demolished/ In Use	U-238	1 in/near Fuel Element Drop Site; 3 elsewhere.
4814	Sodium-Water Reaction Test Structure, Large leak Injector Device	Demolished	Cs-137	2
4885	Pistol Range	Demolished	U-238, U-234, U-235, U-236, Pu-239, Pu-240, Pu-241, Pu-242, Th-232, Na-22, Na-24, Cr-51, Mn-54, Fe-59, Co-60, Kr-85, Sr-89, Sr-90, Sb-125, I-131, Cs-134, Cs-137, Ce-141, Ce-144, Ba (La)-140, Nb-95, Ru-103, Ru-106, Xe-133, Xe-135, Pm-147, Sm-151.	1
4886	Sodium Burn Pit, Sodium Disposal Facility	Demolished	U-238, U-234, U-235, U-236, Pu-239, Pu-240, Pu-241, Pu-242, Th-232, Na-22, Na-24, Cr-51, Mn-54, Fe-59, Co-60, Kr-85, Sr-89, Sr-90, Sb-125, I-131, Cs-134, Cs-137, Ce-141, Ce-144, Ba (La)-140, Nb-95, Ru-103, Ru-106, Xe-133, Xe-135, Pm-147, Sm-151.	1

Building No: 4143
Sodium Reactor Experiment
Period: 4/1957 to 2/1964
Power Level (kW): **20000**
Power Generated (MWd): **6700**
Radioactivity (10^3 Ci): **120000**

Building No: 4028
Shield Test Irradiation Facility
Period: 12/1961 to 7/1964
Power Level (kW): **50**
Power Generated (MWd): **1**
Radioactivity (10^3 Ci): **300**

Building No: 4010
S8ER Test Facility
Period: 5/1963 to 4/1965
Power Level (kW): **600**
Power Generated (MWd): **215**
Radioactivity (10^3 Ci): **3600**

Building No: 4028
Shield Test Irradiation Facility
Period: 8/1964 to /1974
Power Level (kW): **1000**
Power Generated (MWd): **28**
Radioactivity (10^3 Ci): **3714**

Building No: 4010
Systems for Nuclear Auxiliary Power
(SNAP) Experimental Reactor Facility
Period: 9/1959 to 12/1960
Power Level (kW): **50**
Power Generated (MWd): **13**
Radioactivity (10^3 Ci): **300**

Building No: 4093
L-85 Nuclear Experimentation Reactor
Period: 11/1956 to 2/1980
Power Level (kW): **3**
Power Generated (MWd): **2**
Radioactivity (10^3 Ci): **18**

Building No: 4012
SNAP Critical Equipment
Period: 1961 to 1971
Later SNAP criticality tests

Building No: 4021
Radioactive Materials
Disposal Facility
Constructed 1959

Building No: 4073
Kinetics Experiment Water Boiler
Period: 7/1956 to 11/1966
Power Level (kW): **1**
Power Generated (MWd): **1**
Radioactivity (10^3 Ci): **6**

Building No: 4024
SNAP Environmental Test Facility
Period: 4/1961 to 12/1962
Power Level (kW): **65**
Power Generated (MWd): **13**
Radioactivity (10^3 Ci): **390**

Building No: 4019
SNAP Flight Systems
Period: 1962
SNAP flight system criticality

Building No: 4024
SNAP Environmental Test Facility
Period: 1/1965 to 3/1966
Power Level (kW): **37**
Power Generated (MWd): **16**
Radioactivity (10^3 Ci): **6000**

Building No: 4059
SNAP Development Reactor Facility
Period: 5/1968 to 12/1969
Power Level (kW): **619**
Power Generated (MWd): **182**
Radioactivity (10^3 Ci): **220**

Building No: 4024
SNAP Transient Test
Period: 1967 to 1969
SNAP transient response tests

Building No: 4100
Fast Critical Experiment
Period: 1961 to 1972
Started as Advanced Epithermal
Thorium Reactor (AETR)

Building No: 4009
Organic Moderated Reactor
Period: 1958 to 1967
Basic tests of reactor concept

Building No: 4009
Sodium Graphite Reactor
Period: 1958 to 1967
Basic tests of reactor concept

Building No: 4055
Nuclear Material
Development Facility
Constructed 1967

Site No: 4886
Sodium Burn Pit
Sodium Disposal Facility
Constructed 1956

Building No: 4020
Hot Laboratory
Component Development
Hot Cell
Constructed 1959

Building No: 4373
SNAP Critical Test
Period: 1957 to 1963
First SNAP-2 criticality tests

12th St.
11th St.
17th St.
18th St.
18th St.
F St.
24th St.
22nd St.
20th St.
G St.
Ctl IV Rd.
Arness Fire Rd.
H St.
22nd St.
J St.
24th St.

Legend

Area IV Boundary

Buildings of Interest

N

0 50 100 200
Scale In Feet

Santa Susana Field Laboratory
Final Historical Site Assessment

Plate 1
Area IV
Buildings of Interest

U.S. EPA Region 9

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Path: Y:\Santa_Susana\EP9038\TM\Area_4_Buildings.mxd
Project: EP9038
Edited: 12/05/2011 TJ
Source:Boeing Company, 2008
CIRGIS, 2007

HGL HydroGeoLogic, Inc

Redacted

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