FINAL
TECHNICAL MEMORANDUM
SUBAREA HSA-5B
HISTORICAL SITE ASSESSMENT
SANTA SUSANA FIELD LABORATORY SITE
AREA IV RADIOLOGICAL STUDY
VENTURA COUNTY, CALIFORNIA

Prepared for:

EPA Contract Number EP-S7-05-05
Task Order Number: 0038

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LIST OF ACRONYMS AND ABBREVIATIONS

AEC	U.S. Atomic Energy Commission
ARRA	American Recovery and Reinvestment Act
Atomics International	Atomics International Division of North American Aviation, Inc.
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Ci	Curie
COC	Contaminant of Concern
D&D	decontamination and decommissioning
DCGL	derived concentration guideline limit
DHS	Department of Health Services
DOE	Department of Energy
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
DTSC	Department of Toxic Substances control
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
ETEC	Energy Technology Engineering Center
FA	fill area
HSA	Historical Site Assessment
HGL	HydroGeoLogic, Inc.
HMSA	hazardous material storage area
HR	House Resolution
kWth	kilowatt thermal
LCTL	Large Component Test Loop
LMEC	Liquid Metal Engineering Center
μR/hr	micro roentgen per hour
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mR/hr	milli roentgen per hour
mrad/h	milli rad per hour
MWd	megawatt days
NaK	sodium potassium
NBZ	Northern Buffer Zone
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
OS	open storage
PA	processing area
pCi/g	picocuries per gram
RCRA	Resource Conservation and Recovery Act

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RFI	RCRA Facility Investigation
RHB	Radiologic Health Branch
RMHF	Radioactive Material Handling Facility
S2ER	SNAP 2 Experimental Reactor
S8ER	SNAP 8 Experimental Reactor
SER	SNAP Experimental Reactor
SB	Senate Bill
SBZ	Southern Buffer Zone
SCTI	Sodium Component Test Installation
SCTL	Small Component Test Loop
SHEA	Safety Health and Environmental Affairs
SNAP	Systems for Nuclear Auxiliary Power
SSFL	Santa Susana Field Laboratory
TM	technical memorandum
TO	task order
UPS	uninterruptible power supply
UST	underground storage tank
WDA	waste disposal area

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1.0 INTRODUCTION

This technical memorandum (TM) presents a summary of the identified environmental concerns associated with past radiological operations within a portion of Area IV at the Santa Susana Field Laboratory (SSFL) site located in eastern Ventura County, California (Figure 1.1). The SSFL site consists of four areas: Areas I, II, III, and IV; and two buffer zones: the Northern Buffer Zone (NBZ) and the Southern Buffer Zone (SBZ). The U.S. Environmental Protection Agency (EPA) is conducting a radiological characterization study of SSFL Area IV and the NBZ pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). EPA's study consists of a Radiological Historical Site Assessment (HSA), gamma scanning of accessible areas, geophysical surveys, soil and water testing. EPA's gamma scanning, geophysical, soil and water testing investigations are being developed and presented in separate work plans and data reports.

HydroGeoLogic, Inc. (HGL) has been tasked by EPA to conduct the radiological characterization study within SSFL Area IV/NBZ (hereafter called the "Area IV Study"). Figure 1.2 illustrates the location of Area IV and the NBZ. EPA has elected to subdivide the Area IV Study Area into subareas. Subarea boundaries are based on existing Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) areas for the SSFL site. EPA has further subdivided some RFI areas based on features such as roads, drainage pathways, building use, and number of buildings.

Table 1.1
Area IV Study Area
Subarea Designations

Area Designation	Number of Sites
HSA-3	1
HSA-5A	26
HSA-5B	46
HSA-5C	23
HSA-5D	21
HSA-6	38
HSA-7	18
HSA-8	8
BZ-NE	2
BZ-NW	2

The objective of the HSA component of the radiological study is 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 have been identified, potential areas where radiological contamination may exist at the site will be identified for sampling.

This work is being executed by HGL under EPA Contract EP-S7-05-05, Task Order (TO) 0038 under the technical direction and oversight of EPA Region 9. In accordance House Resolution (HR) 2764, the Department of Energy (DOE) is funding EPA's Area IV Study. DOE elected to fund EPA's study with funding allocated under the American Recovery and Reinvestment Act (ARRA) of 2009. On December 6, 2010, the DOE and the State of California Department of Toxic Substances Control (DTSC) signed an Administrative Order on Consent (AOC) for cleanup of the Area IV and the NBZ. Under this AOC, radiological contaminants will be cleaned up to background concentrations as defined by EPA's July 2011 radiological background study.

1.1 Technical Memoranda and the Radiological Historical Site Assessment

This TM presents information relating solely to sites and buildings located within Subarea HSA-5B. This TM, along with subsequent TMs prepared for the subareas identified in Table 1.1, will be compiled into EPA's Radiological HSA for the Area IV Study Area. Each TM has been made available in draft for review and informal comment by SSFL stakeholders and the general public. EPA is responding to each comment via draft "Response to Comment" tables, which are also made available to SSFL stakeholders. Each draft TM will be edited as described in the Response to Comment tables, and these edits along with any new information made available to EPA will be compiled into EPA's official Radiological HSA for the Area IV Study Area.

The content of each TM will be 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 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, which may be incomplete. The preliminary classifications identified in the TMs will be used to guide the subsequent gamma scanning and multimedia sampling effort. Once more complete historical environmental data has been obtained, and the results of geophysical surveys, gamma radiation scanning surveys, field observations, and the results of soil sampling and laboratory analyses are available, the preliminary classifications presented in the TMs will be revised.

1.2 Goals and Methodology of this TM

This TM is focused on radiological information within Subarea HSA-5B and the drainage channels that lead to and from this area. The location of Subarea HSA-5B is shown on Figure 1.3. Plate 1 presents a summary of the features related to potential radiological sources identified within the HSA-5B subarea. Detailed information pertaining to the use of radioactive materials and the potential release of radionuclides at sites and buildings within HSA-5B are provided in Sections 2 and 3 of this TM. Preliminary findings specific to Subarea HSA-5B presented in this TM 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.

As specified in MARSSIM, a "site" is defined as any installation, facility, or discrete, physically separate parcel of land, or any building or structure or portion thereof, that is being considered for survey and investigation (MARSSIM, Revision 1, August, 2000). MARSSIM guidance defines all sites as either "non-impacted," or "impacted" by radiological operations. All of the sites at the Area IV Study Area are considered to have a reasonable potential for residual contamination, so none is classified as "non-impacted." Impacted areas of the Area IV Study Area are divided into one of three classifications.[1]

- *Class 1 Areas:* Areas that have, or had prior to remediation, a high potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiation investigations).
- *Class 2 Areas:* Areas that have, or had prior to remediation, a medium potential for radioactive contamination or known contamination.
- *Class 3 Areas:* Areas that have a low potential for radioactive contamination.

The information provided in this TM together with comments and recommendations provided by SSFL stakeholders and the general public will be used in the EPA's investigation strategy for sampling and analysis for residual radiological contamination in surface and subsurface soil within Subarea HSA-5B. As noted above, EPA will continue to obtain and receive information relating to use and possible releases of radionuclides within the Area IV Study Area. Some of the information presented in this TM may change as new information is obtained, or further evaluation of current information results in changes. In addition to the HSA, information gathered by EPA's Area IV and NBZ gamma scanning program and targeted geophysical investigation will assist EPA in fine-tuning the overall investigation strategy for the Area IV Study Area, and in making the final determination of the appropriate MARSSIM classifications.

1.3 Brief Description and History of SSFL Area IV and the NBZ

The SSFL site occupies 2,850 acres of rocky terrain with approximately 700 feet of topographic relief near the crest of the Simi Hills. The Area IV Study Area comprises approximately 465 acres. Though some of the study area is relatively flat, some portions of the area exhibit steep relief and rugged terrain. The site elevation is between 1,880 feet and 2,150 feet above sea level. The overlying soils of the Area IV Study Area consist of weathered bedrock and alluvium that

[1] *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Revision 1*, NUREG-1575, Rev. 1, EPA 402-R-97-016, Rev. 1, DOE/EH-0624, Rev. 1, August 2000, pp. 2-5.

have been eroded primarily from the surrounding Chatsworth and Santa Susana formations. Several geological faults cross this area.

The climate in the vicinity of the SSFL site is classified as Mediterranean Subtropical, corresponding to an average temperature of 50 degrees Fahrenheit in the winter and 70 degrees Fahrenheit in the summer. Rainfall averages approximately 18 inches per year.

A shallow groundwater system exists in the surface soils at small isolated locations. A regional groundwater system exists in the deeper fractured Chatsworth Formation. In some areas, groundwater from the Chatsworth Formation flows through fractures in the rock and emerges at the ground surface as seeps or springs. Groundwater underlying the SSFL site is not currently used, or anticipated to be used, as a source of drinking water for the nearby communities or at SSFL, but nearby residents may in the future consume groundwater emanating from this site

In addition to rocket and small engine testing facilities in other portions of the SSFL, North American Aviation, Inc., had facilities at Area IV for researching, developing, and constructing equipment to use nuclear energy through its Atomics International Division (AI).[1] According to a 1959 company brochure, AI maintained a nuclear field test area covering approximately 300 acres at the SSFL site.[2] Under contract to DOE and private customers, AI supported the development of civilian nuclear power, as well as the testing of non-nuclear components related to liquid metals within 90 acres of Area IV of the SSFL site. The facilities within these 90 acres would later be referred as the Energy Technology Engineering Center (ETEC).[3]

Nuclear facilities at ETEC included 10 nuclear research reactors over the period July 1956 through February 1980. These research reactors are listed in Table 1.2.

[1] North American Aviation, Inc., *The North American Story,* December 1960, p. 7
[2] Atomics International, A Division of North American Aviation, Inc., *Atomics International,* December 1959, p. 5.
[3] http://www.etec.energy.gov/History/Area-IV-History.html

Table 1.2
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 1.3. Other nuclear facilities within Area IV included the Radioactive Materials Disposal Facility and the Hot Laboratory, as well as the Sodium Disposal Facility, or Area IV burn pit. Each of these facilities will be addressed as a site within the appropriate TM along with supporting buildings and open areas.

According to the DOE ETEC web site, most nuclear research related programs and operations ceased in 1988 and were replaced with decontamination and decommissioning operations.[3]

[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
[3] http://www.etec.energy.gov/History/Area-IV-History.html

Table 1.3
Criticality Test Facilities at the Santa Susana Field Laboratory[1]

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

The NBZ is a 175-acre parcel of land that abuts the SSFL property (Figure 1.2). The NBZ is a naturally vegetated area containing drainage channels that transport surface water from the SSFL downslope to surrounding populated areas.[2] The NBZ was purchased by the Rocketdyne Division of Rockwell International (Rockwell) in 1998 from the adjoining Brandeis-Bardin Institute because an environmental contractor found that the NBZ contains radioactive and chemical contamination that had migrated from the SSFL.

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.

1.4 Brief Description and History of HSA-5B

Subarea HSA-5B is approximately 23.2 acres of flat land. Over the years, 41 buildings have been situated within HSA-5B. It includes B, F, G, and 17th through 20th streets. Drainage is generally to the south. An impoundment was located at the intersection between G and 17th Street in Subarea HSA-5B. This impoundment retained water during the mid- to late-1960s. Radiological operations in Subarea HSA-5B related to the SNAP and SNAP 8 programs.

1.5 Sites in HSA-5B

During the peak of operations, Subarea HSA-5B comprised 46 primary sites, most of which were buildings, and 22 associated sites, such as electrical substations, power supplies, electrical equipment pads, and time clocks. This TM addresses each of these 46 sites within Subarea HSA-5B. Of the 46 sites, one was a reactor building (Building 4010), two were criticality test facilities (Buildings 4012 and 4019), and others housed operations involving radioactive materials. One site was a drainage area that became radioactively contaminated. It is important to note that EPA and HGL continue to obtain and receive information that may alter the findings of this TM. Of the 46 sites in Subarea HSA-5B, only 4 buildings remain today.

[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. 25.
[2] Agency for Toxic Substances and Disease Registry, *Draft Preliminary Site Evaluation, Santa Susana Field Laboratory*, Atlanta, GA, December 3, 1999, pp. 2-5.

1.6 Site Summary Methodology

In preparing this TM, the following types of documents were reviewed:

- radiological characterization reports;
- previous radiological surveys;
- decontamination and decommissioning (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. 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 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 offsite facilities. The information acquisition process is generally complete with one exception; monthly supplemental responses are received from the DOE. If pertinent information is later acquired by EPA, it will be added to this TM and integrated into our radiological characterization study process to ensure that all available, relevant information is considered by EPA prior to the completion of our study.

EPA sent Boeing its original information request letter on June 24, 2009. Boeing provided an initial response to this request on August 31, 2009, and a supplemental response on December 10, 2009. On June 8, 2010, Boeing provided relevant site drawings and maps as identified by EPA during a review of flat files at Boeing's Safety, Health, and Environmental Affairs (SHEA) building on site. Subsequently, on June 17, 2010, EPA sent Boeing a supplemental information request letter specifically requesting all maps, diagrams, and as-built drawings for past and current buildings in Area IV. On July 15, 2010, Boeing responded and provided additional documents, including maps and drawings. On November 15, 2010, Boeing provided a third supplementary group of documents. Additional information requests have been ongoing and during the months of December 2010 and January, March, April, May, June, July, and August of 2011, Boeing provided numerous additional documents in response to both EPA original information requests and EPA queries of Boeing's document database for the SSFL.

In October 2010, EPA also sent the National Aeronautics and Space Administration (NASA) a formal information request letter. On November 22 and December 2, 2010, EPA received information responsive to this request.

EPA sent DOE its original information request letter on June 24, 2009. DOE provided an initial response to this information request on August 31, 2009. Subsequently, DOE has provided supplemental responses to this initial information request on a monthly basis. Additional information responsive to the EPA's information request has been received in September, October, November, and December 2009, as well as January through December 2010 and January, February, March, April, May, June, and July 2011. On June 17, 2010, EPA sent DOE a supplemental request for information, specifically requesting maps, diagrams, and as-built drawings for past and current buildings in Area IV. Starting in its July 2010 supplemental response to EPA, DOE is providing information that is responsive to both of the EPA information requests letters.

Other requests for information pertaining to the site have included § 104(e) information request letter sent to the NRC and CDPH. The purpose of the inquiries to both the NRC and the CDPH was to identify and obtain any nuclear materials licenses pertaining to the site that may not have been captured via the information requests sent to other parties.

In preparing the HSA-5B TM, 669 individual documents and photographs were reviewed. The review process was conducted by first screening over 80,000 documents amassed for the project. This screening effort produced 669 documents relevant to past operations at facilities within HSA-5B and were therefore determined to warrant in-depth evaluation. Each of these 669 relevant documents was thoroughly evaluated for information considered useful for assigning MARSSIM classifications.

1.6.1 Contents of EPA's Site-by-Site Analyses

The subject areas considered and addressed for each site discussed in Section 2 of this 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 has been 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 is 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, will be recorded in EPA's HSA process.

At the time of writing this TM, the EPA had completed forty-nine (49) interviews. Under the DOE/EPA joint interview program, eighteen (18) interviews have been conducted. Approximately 107 former employees have requested to be interviewed by DOE only and those interviews are complete. An additional eighty five (85) people were referred to EPA and DOE by interviewees during the course of the interviews, and of these, only twenty (20) could be located, which resulted in four (4) additional interviews. DOE has provided all of their interview transcripts to EPA for use in EPA TMs. For this TM, 16 interviews were relevant to the HSA-5B subarea.

The interview information obtained to date relevant to this TM is depicted on the relevant Plate 1 figure.

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.

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 (Table 3.3) lists 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 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 are nearing completion with EPA leading the radiological background study and the DTSC leading the chemical background study. The potential for radiological contamination is quantified in this TM 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.

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.

2.0 FINDINGS

This section organizes the building areas within HSA-5B according to eight logical "clusters" (a.k.a. groups) based on operational characteristics and geographic locations. Plate 1 depicts the entire HSA-5B subarea and should be referenced while reading Section 2. Each HSA-5B group (discussed in Sections 2.1 through 2.8, below) is depicted in an accompanying group map, which serves as a guide for the text describing the building areas in that group and also as an index for the group's site photograph and building layout drawings.

2.1 Group 1

The Group 1 index map is presented in Figure 2.1. Following Figure 2.1, the site photograph and layout drawings for each building area within HSA-5B Group 1 are presented. HSA-5B Group 1 includes seven building areas containing the Building 4010 Systems for Nuclear Auxiliary Power (SNAP) reactors, the Building 4012 SNAP Critical Test Facility, the Building 4019 SNAP Flight Systems Facility, two non-nuclear SNAP support buildings, the Sodium Component Test Installation (SCTI) Power Pak building, and a portable change room. Note that Building 4310, the portable change room, was later moved to support the Small Component Test Loop (SCTL). As a result, Building 4310 will be discussed as appropriate in Group 1 and Group 6 of this section.

2.1.1 Building 4010 Area

Site Description: The Building 4010 area comprises Building 4010, Electrical Equipment Pads 4807 and 4808, Air Blast Heat Exchanger Pad 4809 and the land that surrounds these sites located off B Street. The small grade-level concrete pads allowed for the mounting of support equipment. Building 4010 was constructed in 1959 as the SNAP Experimental Reactor (SER).[1,2] Figures 2.1.1a through 2.1.1d provide a current photograph and the best available building-specific drawing(s) that the research team could find. Building 4010 was located east of SNAP Critical Test Facility Building 4012. No as-built drawings have been located for Building 4010. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4010 was a steel-framed structure with corrugated metal siding and roofing. The building measured 60 feet long by 24 feet wide with 17-foot ceilings. A buried radioactive gas holdup tank and a drainage sump were identified as support facilities exterior to Building 4010. The subsurface structure of Building 4010 was composed of three steel-reinforced concrete vaults with a maximum depth of 14 feet below grade. All three vaults were located in the reactor room, occupying the southern 34 feet of the building.[3,4] Figure 2.1.1d provides a schematic drawing showing the three vaults. Figure 2.1.1b provides a plot plan showing the water lines, sewer lines, and drain flow around Building 4010. Figure 2.1.1c

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[1] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, p. 17.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, pgs. 10-11.
[4] Ashley, R.L. et al., *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities, NAA-SR-7300*, Atomics International, May 25, 1962, pgs. V-12 –V-14.

provides a floor plan of Building 4010 in 1962 showing the location of tanks and sumps. These figures provide details on the tanks and piping associated with Building 4010. A sanitary sewer line is identified at the north end of Building 4010.[1]

A leach field was located west of Building 4010 and received flow from a 750-gallon septic tank connected to the building (see Figure 2.1.1e). The leach field was constructed of 4-inch-diameter terra cotta clay piping surrounded by gravel and buried at depths ranging from 2 to 6 feet below ground surface. The leach field consisted of 90 linear feet of leach lines. In 1961, Building 4010 was connected to the sanitary sewer system and the leach field and septic tank were removed. The Building 4010 leach field was covered with compacted fill to support the construction of adjacent buildings.[2,3,4] A 2003 Resource Conservation and Recovery Act Facility Investigation (RFI) report on Area IV leach fields states that the Building 4010 leach field was mistakenly identified as a leach field for Building 4012 in a 1994 RFI report.[5] A 2008 RFI report suggests that the leach field and septic tank were abandoned in place; however geophysical surveys did not detect these features, and other sources cited above claim these features were removed.[6] Lines leading to the septic tank and leach field were exposed and surveyed during decommissioning. Contamination was below acceptable limits in 1978 and the sewer lines were left in place.[7,8] (See Previous Investigations below for acceptable limits.)

A 2008 RFI report identifies a 630-gallon underground storage tank (UST) located 23 feet from the north corner of Building 4010. The contents of this tank are unknown. A compressed gas aboveground storage tank is also noted on the east side of Building 4010, but the type of gas and tank capacity is unknown. Cooling water pipelines were located beneath Building 4010 and between Building 4010 and the air compressor pad east of the building.[9]

Former Use(s): Building 4010 housed the SER, also known as the SNAP 2 Experimental Reactor (S2ER), which was a prototype for the basic SNAP reactor and used for power demonstration and endurance tests. The SER/S2ER operated in Building 4010 from September 1959 to December 1960 at a power level of 50 kilowatt thermal (kWth). After completion of the

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[1] *Santa Susana Field Laboratory Site Development Plan, Existing Development, Sanitary Sewage System*, Rockwell International Corporation, Unknown date, HDMSE00688360.

[2] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume VIII – RFI Site Reports, Appendix P, United States Department of Energy Leach Fields 2*, CH2M Hill, Draft in Progress November 2008, pgs. P.2-1, Table P.2-4.

[3] Wynveen, R.A. et al., *Interim Post Remedial Action Survey Report for Systems for Nuclear Auxiliary Power-8 (SNAP-8) Experimental Reactor Facility (Building 010), Santa Susana Field Laboratory, Rockwell International, Canoga Park, California*, Argonne National Laboratory, May 1983, p.1.

[4] Wallace, J.H., *Radiological Survey Results - Release to Unrestricted Use, Building 010 at SSFL, N704TI990041*, Rockwell International, Atomics International Division, August 28, 1978, p. 3.

[5] Montgomery Watson Harza, *DOE Leach Fields (Area IV AOC) RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Draft*, October 2003, pgs. 2-2–2-3.

[6] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume VIII – RFI Site Reports, Appendix P, United States Department of Energy Leach Fields 2*, CH2M Hill, Draft in Progress November 2008, pgs. P.2-1, Table P.2-4.

[7] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, pgs. 33, 36.

[8] *Long-Range Plan for Decommissioning Surplus Facilities at the Santa Susana Field Laboratories, N001TI000200*, Rockwell International, Unknown Date, p. 75.

[9] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume VIII – RFI Site Reports, Appendix P, United States Department of Energy Leach Fields 2*, CH2M Hill, Draft in Progress November 2008, pgs. P.2-1, Table P.2-4.

SER/S2ER operations, the reactor and associated test equipment were removed from the building and sent offsite for disposal. In 1961, improvements and modifications were made to Building 4010 to allow for testing of the higher power level SNAP 8 Experimental Reactor (S8ER). The S8ER was a prototype for the SNAP 8 reactors. The S8ER operated in Building 4010 from May 1963 to April 1965 at a power level of 600 kWth.[1,2,3] Figure 2.1.1d presents a schematic drawing of the S8ER.

At the conclusion of the S8ER experiment in 1965, the reactor, primary and secondary sodium loops, and control panels were removed from the building. The primary vault, which still contained surface contamination, and the reactor containment vessel, which still contained induced radioactive materials, were covered with shielding blocks to restrict access and shield the remaining radiation. Plans for facility reuse did not materialize and Building 4010 remained unused for nine years until being declared surplus in 1974. Decommissioning and decontamination work occurred though the winter of 1977 and 1978.[4] A large structure consisting of four cooling towers (SCTI Power Pak Cooling Tower Building 4710) was constructed in the approximate location of former Building 4010 in the late 1980s and was operated until the mid-1990s. The cooling towers were removed during 2003.[5,6]

Information from Interviewees: A number of former employees were interviewed about their experience at the SSFL. Five remembered Building 4010. Excerpts from their interviews are included below.

Interviewee 8 was an employee of Atomics International and its successors from 1956 to 1997 and then worked as a contractor for another 10 years. The interviewee was a project administrator who primarily worked at the Van Owen facility, but occasionally visited the Santa Susana Field Laboratory. The following excerpts were pulled from the interview.

> *"The SNAP reactors at SSFL used beryllium reflectors. I don't know that they ever had any problems with that, but beryllium is pretty toxic stuff."*[7]

Interviewee 5 was a responsible engineer at Atomics International from 1958 to 1962. The following excerpts were pulled from the interview.

> *"Building 10 was a SNAP test facility…. During the testing of the SNAP 8 reactor, the cooling system for the containment vessel developed leaks and so we built a Bar's Leak injection system. Bar's Leak was a radiator sealant. It was*

[1] Brinkman, D.S., *S8ER Operations Manual, Volume 1, Description and Operating Procedures, NAA-SR-MEMO-7222*, Atomics International, November 1, 1962, pgs. 3-4.
[2] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, p. 15.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 – Methodology*, May 2005, pgs. 2-5–2-6, 2-9.
[4] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, pgs. 15, 27.
[5] Montgomery Watson Harza, *DOE Leach Fields (Area IV AOC) RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Draft*, October 2003, pgs. 2-2–2-3.
[6] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.
[7] Interview No. 8 conducted by DOE and EPA on July 14, 2010.

> *some kind of sodium solution product. We injected that into the cooling system to plug up the leaks and it did. There was residual sodium in the cooling system and it became radioactive. I suspect there may have been some contamination from leaks, but I don't have first-hand knowledge."*[1]

Interviewee 107 was an engineer at Atomics International from 1961 to 1973 and worked on the SNAP 2, SNAP 10/10A, and S8ER programs. The following excerpts were pulled from the interview.

> *"I worked on the S8ER in Building 10, which was much larger than the SNAP 10/10A reactors. But after 2 years, the S8ER was shut down."*[2]

Interviewee 155 started work at the Santa Susana Field Laboratory on February 2, 1959 as a fireman and then transferred to the Radiation Safety Department. The following excerpt was pulled from the interview.

> *Building 10 was the S8ER and was the second reactor they had in that building. The outside of the containment vessel was leaking water which was the vessel coolant. I was not aware if they were using lithium in this building. To stop that leak, Bar's Leaks was used. You may want to see if irradiation of that product would produce tritium. Building 28 was real close to Building 10 and they had a swimming pool reactor in that building. Look at the elevations of the two buildings – I bet the vessel in Building 28 was probably lower than the Building 10 vessel.*[3]

Interviewee 427 worked for Atomics International beginning in June 1957 and was initially assigned as a test engineer to the pyroprocessing refabrication experiment and later went on to work on zirconium hydride reactor systems at the Santa Susana Field Laboratory. The following excerpts were pulled from the interview.

> *"After we proved we could build a hydride reactor, the real work began on the SER, not to be confused with the SRE. We wore film badges and were monitored, and worked inside a security fence. There were health physicists onsite.*
>
> *I have transported enriched fuel elements, three at a time, in the back of my VW from the plant at the bottom of hill where they were constructed at Atomics International (the Van Owen Facility) up the hill to SSFL. Everything was contained within the fuel elements. NaK was the flowing coolant in the primary and secondary systems and heat exchangers.*
>
> *Any experimental reactor is always "off-normal"! We had a NaK leak inside the vault. There was a little water in the bottom of the vault that condensed from the concrete, and the heater leaked NaK which caused the metal membrane that sealed the vault to raise the concrete blocks rhythmically! We thought it was a leak in the primary, but it was actually in the exchanger. It was just gas created*

[1] Interview No. 5 conducted by EPA on August 23, 2010.
[2] Interview No. 8 conducted by DOE and EPA on July 14, 2010.
[3] Interview No. 155 conducted by DOE in 2010.

by the reaction of the NaK with the water, but it sure got our attention for the remainder of the test program! The DeSoto folks wrote up the reports.
For safety purposes, the reactor was located in a big steel tube way down at the bottom and controlled by long rods going down to the reactor reflector controls. We had an air-blast heat exchanger on the outside of the building to get rid of excess heat. You had to load the fuel, seal the reactor, and then load the liquid metal NaK. There were many steps to be followed.

The only radiation exposure would be coming through the shielding—it would not be airborne, but we had people coming through and monitoring us to ensure we hadn't been exposed. I was never involved in the disassembly of the SER…

The biggest disposal problem we had was getting rid of contaminated NaK coolant. For each test you had to drain and re-fill, so there was a lot of NaK you had to get rid of. You would wet the NaK with steam and it would "hiss" a little bit and then it would be gone. They did this on the outside of the test buildings.

For the hardware that was contaminated, we would turn it over to a group of guys that had a "sodium burn pit". A friend of mine who worked on the sodium component, QSU, learned that things can happen when mixing steam with alkaline metals. You can drain the sodium out, but there is still hardware contaminated with sodium that you have to clean up and what do you do with that? I never buried or hauled anything to the sodium burn pit.

The SNAP Program was a very fast-moving project. My principle job was to run and evaluate the engineering design of the integrated system so I got involved in designing the building to accommodate future SNAP tests. I went from being a Test Engineer on the SER to a Supervisor of non-nuclear testing in Building 32." [1]

Radiological Incident Reports: There have been several incidents associated with Building 4010 that could have resulted in a release to the environment. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4010 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0598	4/30/1961	SER BLDG 10		REFERS TO SAMPLES FROM APRIL INCIDENT AT SER.
A0277	1/1/1964	SNAP-8 CORE	MFP	FISSION PRODUCT RELEASE FROM CLADDING FAILURE OF SNAP 8 REACTOR FUEL.
A0349	10/19/1965	HIGH BAY	ACP	SAW CUTTING OF CONTROL RODS RESULTED IN

[1] Interview No. 427 conducted by DOE in 2010.

				CONTAMINATION OF BLDG.

- On April 30, 1961, an unknown incident occurred in Building 4010. Incident Report A0598 referenced the April incident when it indicated that the processing of samples from the incident would be delayed. The report states that three of the five samples resulting from the recent SER incident will be delayed due to a backlog of analyses for the gamma spectrometer. The three samples for which analysis was delayed were the "'coolie hat' smear, the smear of the upper grid plate, and the metallic fragments scraped from the core." Analysis of two samples following the incident was completed. The first sample was composed of dust removed from the constant air monitor filter. The air monitor had been operating inside the reactor at the time of the incident. The second sample consisted of smears taken of the interior sides of the reactor below the core. The following radioisotopes were found in both samples: cesium-137 (Cs-137), antimony-124 (Sb-124), cobalt-60 (Cp-60), scandium-46 (Sc-46), manganese-54 (Mn-54), strontium-90 (Sr-90), and yttrium-90 (Y-90). The air filter dust sample had a total activity of 2.20×10^{-1} microcuries per gram (uC/gm) and the smears below the core had a total activity of 1.23×10^{-1} uC (no units of weight were included since this was considered a surface sample) (Incident Report A0598).[1]

- On January 1, 1964, mixed fission product was released to the cover gas and sodium potassium (NaK) coolant as a result of cladding failure of SNAP 8 reactor fuel (Incident Report A0277).[2] A "substantial release of fission products due to cladding failure occur[ed] in about 80% of the fuel rods during the reactor's extended endurance run."[3] The uranium-zirconium fuel swelled stretching the cladding beyond its ductility limit. This caused cracks in the cladding that allowed fission products to diffuse into the NaK. There was no melting of the fuel or cladding and all fission products were completely contained within the reactor system.[4,5]

- A 2008 RFI report lists a July 5, 1961 and a June 11, 1964 incident related to Building 4010. The details of these incidents are unclear at this time. The documents referenced for this information in the RFI have been reviewed and do not suggest radiological incidents on these two dates. A review of Boeing's Radiological Incident Database does not include any incidents on these dates. It is unclear if the statements in the RFI are accurate. If any additional information comes to light regarding these possible incidents, this technical memorandum will be updated.[6]

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[1] Internal Correspondence from Copeland, A.A. to Carpenter G.D., Atomics International, *Re: Status Report on Analysis of Samples Resulting from the Incident at SER in April, 1961*, June 27, 1961.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-2.
[3] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 10.
[4] Oldenkamp, R.D. and Mills, J.C., *Nuclear Operations at Rockwell's Santa Susana Field Laboratory – A Factual Perspective, N001ER000017*, Rockwell International, December 20, 1989, p. 86.
[5] *S8ER Fuel Failures*, Unknown Author, October 5 1999, HDMSp01708835.
[6] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume VIII – RFI Site Reports, Appendix P, United States Department of Energy Leach Fields 2*, CH2M Hill, Draft in Progress November 2008, p. Table P.2-1.

- In addition to the incident reports, two leaks in cooling lines are known to have occurred. One leak occurred in the shield cooling water lines under the vault floor and another leak was identified in the reactor containment vessel cooling lines in the earth near the concrete shield. Both leaks were repaired, and no extensive decontamination was found to be required or performed.[1] These leaks may have promoted the release of tritium.[2] Building 4010 has been identified as the source of tritium in a neighboring groundwater well.[3]

- An additional, though unlikely, potential for release of tritium to surface water occurred upon removal of the S8ER reactor shield from the ground, for disposal as radioactive waste. The concrete shield was excavated and removed on February 16, 1978, and stored outside, presumably on a paved storage area, at the Radioactive Materials Handling Facility (RMHF). On or before May 22, 1978, the shield was reportedly thoroughly wrapped in plastic sheeting, isolating it from the environment. During the time it was exposed, rain fell on the shield and could have extracted a small amount of tritium from the concrete. Rainfall runoff from the RMHF is collected in a sump and pumped to surface drainage, which ultimately flows to Rocketdyne Retention Pond R-2A located in Area II.[4,5,6]

- On May 18, 1965, a NaK fire occurred in the reactor pit in Building 4010. The fire was extinguished by placing the cover on the reactor pit and flooding it with argon. No personal injury or property damage was reported to be sustained.[7]

Current Use: Demolished in 1978.[8] No structures remain at the building site and the area is paved over for use as a parking lot. A 1979 decommissioning report discusses excavation of Building 4010, but does not provide any excavation dimensions.[9] No other excavation information has been located.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): A chronology of radiological investigations at this building is as follows:

[1] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, pgs. 13, 15-16.
[2] Tuttle, R.J. *Tritium Production and Release to Groundwater at SSFL*, Rockwell International, Rocketdyne Division, September 25, 1992, pgs 61-62.
[3] The Boeing Company, Rocketdyne Environmental Affairs, *Building 4010 – SNAP-8 Experimental Reactor*, February 10, 2000, pgs. 1-2.
[4] Tuttle, R.J. *Tritium Production and Release to Groundwater at SSFL*, Rockwell International, Rocketdyne Division, September 25, 1992, pgs. 61-62.
[5] MWH Americas, Inc., *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California, Revision 2 – Final*, September 2005, pgs. Table 1-3, Table 1-4, Figure 1-5.
[6] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 – Methodology*, May 2005, p. 3-13.
[7] Internal Correspondence from Wilmes, R. to Lang, J., Atomics International, a Division of North American Aviation, Inc., *Reference: Monthly Progress Report for Industrial Hygiene and Safety, Santa Susana, Period Ended May 29, 1965*, dated June 2, 1965, p. 3.
[8] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 – Methodology*, May 2005, pgs. 2-5–2-6, 2-9.
[9] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, p. 46.

- **Decontamination Limits**. Guide limits were established for decontamination of the Building 4010 area. The objective was to leave all decontaminated areas at radiation levels as low as practicable, but in all cases to levels below 0.1 millirad per hour (mrad/hr) at 1 centimeter for total beta-gamma emmiters, 100 disintegrations per minute per 100 square centimeters (dpm/100 cm^2) for removable beta-gamma emmitters, 100 dpm/100 cm^2 for total alpha emmiters, and 20 dpm/100 cm^2 for removable alpha emitters. Activated soil was to be removed as near as practicable to the natural background levels, but in all cases to less than 100 picocuries per gram (pCi/g) gross detectable beta activity.[1,2,3]

- **1978 Atomics International Radiological Survey**. In 1978, Atomics International conducted a radiological survey following decontamination and demolition. The survey included 200 smears for removable contamination along smooth surfaces (concrete, piping, and steel surfaces), a walk-through survey of surface contamination, soil sampling, concrete sampling, and water sampling. No smears were found to exceed 50 dpm/100 cm^2, including smears of the drains lines to the current sewer and to the previous leach field. Alpha contamination was not expected and none was detected. In a complete walk-through survey that included drain lines, the maximum surface contamination detected was 0.05 mrad/hr with an average background of 0.04 mrad/hr. All readings were below the 0.1 mrad/hr limit. Prior to backfilling, concrete samples were taken from a portion of the equipment vault wall. All samples were less than 50 pCi/g gross beta and all clean sampled concrete was used as backfill for ditch repair between Area I and Area II. Soil samples were collected after backfilling was complete. All samples were less than 50 pCi/g gross beta. During dismantling of the sump drain system and vessel pit, water samples were collected. No samples exceeded 4.5×10^{-8} microcuries per cubic centimeter (µCi/cc), below the limits of 3.0×10^{-7} µCi/cc for Sr-90. All results were below clean up guide limits (see above) for Building 4010 in 1978.[4,5]

- **1979 Argonne National Laboratory Radiological Survey**. In September 1979, Argonne National Laboratory conducted a radiological survey for post remedial assessment of the Building 4010 site to ensure that it met unrestricted release criteria. The building site consisted of an asphalt-paved parking lot at the time. A walkover survey indicated some elevated readings on the asphalt, ranging from 15 to 30 microroentgens per hour (µR/hr) with a natural background ranging from 9 to 15 µR/hr. Further investigation suggested these readings were a result of radioactive materials stored on the hill east of the Radioactive Materials Handling Facility. Soil borings through the asphalt did not detect any uranium-235 (U-235) or uranium-238 (U-238). Other radionuclides including: cesium-137 (Cs-137), thorium-232 (Th-232), radium-226

[1] Stelle, A.M., Facilities Dismantling Plan for Building 10 (S8ER), N704FDP990005, Rockwell International, September 1976, p. 3.
[2] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, p. 20.
[3] Wynveen, R.A. et al., *Interim Post Remedial Action Survey Report for Systems for Nuclear Auxiliary Power-8 (SNAP-8) Experimental Reactor Facility (Building 010), Santa Susana Field Laboratory, Rockwell International, Canoga Park, California*, Argonne National Laboratory, May 1983, p.2.
[4] Wallace, J.H., *Radiological Survey Results - Release to Unrestricted Use, Building 010 at SSFL, N704TI990041*, Rockwell International, Atomics International Division, August 28, 1978, pgs. 6-7.
[5] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, pgs. 33-34.

(Ra-226), and cobalt-60 (Co-60) were identified below clean up guide limits (see above) for Building 4010 in 1979.[1]

- **1979 and 1981 Post Remedial Assessment**. In November 1979 and October 1981, Argonne National Laboratory conducted radiological measurements for post remedial assessment of the Building 4010 site. The building site consisted of an asphalt-paved parking lot. Soil sampling analysis in 1979 found Co-60 contamination, primarily in the southwest quadrant of the building site. The maximum Co-60 level detected was 48.0 picocuries per gram (pCi/g), which was below the U.S. Department of Energy (DOE) criteria level of 100 pCi/g gross beta activity in 1979.[2]

- **1982 Release for Unrestricted Use**. The Building 4010 site was released for unrestricted use by the DOE in December 1982.[3]

Radiological Use Authorizations: Use Authorization No. 18 pertained to radiography in Building 4010.[4] Use Authorization No. 111 pertained to the decontamination and disposition of Building 4010.[5] The research team found no other Use Authorizations pertaining to Building 4010.

Former Radiological Burial or Disposal Locations: Radioactive waste produced by the test reactor was reported as quite small and, as a result, major waste collection or processing systems were not provided for the facility. Small tanks were provided for storage of liquid or gaseous wastes that might have been radioactive.[6] The research team found no other information regarding the small tanks.

Aerial Photographs: Building 4010 was first identified on a 1959 aerial photograph. Aerial photographs from 1965 and 1967 indicate an access road and disturbed ground north of Building 4010 in Subarea HSA-7. In 1967, the southwest portion of the disturbed ground area, north of and between Buildings 4013 and 4019, contains possible liquid waste. By 1972 the disturbed ground is re-vegetated, but ground scarring continues to be noted in aerial photographs through 2005 where the area becomes the subject of earth moving activity. A 1967 aerial photograph indicates that drainage flows southwest from an open storage (OS) area identified as OS-2 in Subarea HSA-7 toward Building 4010. In 1978, Building 4010 is no longer present, but a drainage pathway is noted flowing north from the former Building 4010 area to a liquid-filled impoundment, denoted IM-4, in Subarea HSA-7. In 1980, the drainage pathway to IM-4 is still visible and includes a pipeline, but the impoundment is dry. In 1988, a structure containing cooling fans (Building 4710) was identified near the former location of Building 4010. In 1995,

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-4.
[2] Wynveen, R.A. et al., *Interim Post Remedial Action Survey Report for Systems for Nuclear Auxiliary Power-8 (SNAP-8) Experimental Reactor Facility (Building 010), Santa Susana Field Laboratory, Rockwell International, Canoga Park, California*, Argonne National Laboratory, May 1983, pgs. 1-4.
[3] The Boeing Company, Rocketdyne Environmental Affairs, *Building 4010 – SNAP-8 Experimental Reactor*, February 10, 2000, pgs. 1-2.
[4] Radiation Safety Records Management System Index, The Boeing Company, Reviewed November 8, 2010.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, pgs. L-2, L-5.
[6] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, pgs. 13, 15-16.

a stain is visible near the southeast corner of the cooling fans. By 2005, the cooling fans had been removed and the stain was no longer visible.[1]

Radionuclides of Concern: The SNAP reactors were uranium-zirconium hydride reactors that used fully enriched uranium dispersed in fuel rods containing zirconium hydride. Radionuclides resulting from reactor operations in Building 4010 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137) cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium (H-3), and natural and enriched uranium (U-234, U-235, U-238).[2,3,4] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory* (August 2009 Field Sampling Plan). Beryllium-10 (Be-10) is a potential radionuclide of concern at Building 4010 because beryllium reflectors were used in the SNAP reactor. Be-10 is not anticipated to be found at high concentrations and the decision to sample for Be-10 is being further evaluated. Table 3.3 presents a summary of radiological contaminants of concern.

Fission- and corrosion-product releases associated with a cladding failure in the S8ER that do not meet the criteria for analysis based on the August 2009 Field Sampling Plan include: argon-39 (Ar-39), barium-140 (Ba-140), cerium isotopes (Ce-141, Ce-144), cobalt-58 (Co-58), iodine isotopes (I-131, I-132), iron-59 (Fe-59), lanthanum-140 (La-140), manganese isotopes (Mn-54, Mn-56), niobium-95 (Nb-95), rubidium-86 (Rb-86), ruthenium isotopes (Ru-103, Ru-106), rhodium-106 (Rh-106), strontium-89 (Sr-89), tellurium-132 (Te-132), xenon-135 (Xe-135), and zirconium-95 (Zr-95).[5]

Drainage Pathways: Groundwater drainage for the entire vault complex was provided by a sub-foundation system consisting of circuits of perforated metal pipe surrounded by a gravel fill. The system drained into a pipewell sump located to the east of the building where the intercepted groundwater could be monitored. The water was then either pumped into a tank for controlled disposal if radioactive contamination was detected, or discharged to the site surface drainage system if no contamination was found.[6] The north end of Building 4010 is located near the surface drainage divide for the area. North of the drainage divide water drains northerly to Simi Valley. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs, which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 – Methodology*, May 2005, pgs. 2-6, 2-9.
[3] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, pgs. 5, 10.
[4] DOE/EPA Joint Interview 8, July 2010.
[5] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, pgs. 5, 10.
[6] Stelle, A.M., *S8ER Facilities Decommissioning Final Report, ESG-DOE-13237*, Rockwell International, Atomics International Division, Energy Systems Group, February 28, 1979, pgs. 11, 13.

controlled effluent holdup and sampling.[1,2] Aerial photographs from 1957 to 2005 indicate that drainage followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[3] The 17th Street Drainage is discussed later in this section.

Radiological Contamination Potential: Class 1 because of the former use of Building 4010.

Recommended Locations for Sediment/Soil Sampling:

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

Extensive soil sampling is recommended in the Building 4010 area. As discussed above, 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 Administrative Order on Consent. 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.

- 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

[1] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[2] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

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.

2.1.2 Building 4012 Area

Site Description: The Building 4012 area comprises Building 4012, Electrical Substation 4713, and the land surrounding these buildings located on B Street. Building 4012 was constructed in 1962 as the Systems for Nuclear Auxiliary Power (SNAP) Critical Test Facility.[1,2] Figures 2.1.2a through 2.1.2b provide a current photograph and the best available building-specific drawing(s) that the research team could find. Building 4228, the Sodium Component Test Installation (SCTI) Power Pak facility, was built on top of Building 4012 and is discussed elsewhere in this section. Building 4012 was located near the northern property line of Area IV. The terrain near the northern property line becomes very rugged and there is a 40-foot drop in elevation.[3] No as-built drawings were located for Building 4012. Plate 1 presents a summary of all identified features for this site.

Building Features: The Building 4012 complex originally consisted of two sections connected by an enclosed walkway measuring 34 feet long by 6 feet wide. The southern portion of the building was a prefabricated, steel-framed structure on a concrete slab floor and measured 42 feet long by 28 feet wide. This building included an operations and control room. The northern portion of the building was a concrete structure on concrete floor slabs and measured 46 feet long by 28 feet wide. This building contained a 20 foot long by 20 foot wide critical cell and a 26 foot long by 18 foot wide equipment room.[4,1,2,3]

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-7.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 10.
[4] Pascolla, A.L., *Decontamination and Decommissioning of Building T012, ETEC No. 012-AR-0001*, Boeing North American Inc., Rocketdyne Division, May 8, 1997, pgs. 3, 8.

The critical cell (Room 110) was used to test SNAP critical assemblies. The room was sealed with steel-lined, 4-foot thick concrete walls with a ¼-inch steel liner and a mat-type concrete foundation.[4] The fuel storage and equipment room (Room 109) was located adjacent to the critical cell. The room was divided by a 20-inch thick concrete shield wall containing 1 percent boron by weight. Embedded in the wall were 110 cadmium-plated fuel storage tubes arranged 5 tubes high and 22 tubes wide.[5,6]

Liquid wastes were stored in a low-level radioactive storage tank fed by the sink, shower and floor drain in the change room. Water used in [water] immersion [critical] experiments was also dumped into the low-level storage tank. The Health and Safety Division was responsible for disposition of the storage tank contents.[7] The low-level radioactive storage tank is presumably the same radioactive liquid waste holdup tank located outside the change room (Room 104).[8] This radioactive waste retention tank was sampled and removed in 1973.[9,10] Figure 2.1.2b provides an original floor plan of Building 4012.

Building 4012 had a restroom and a sanitary sewer line is identified at the south end of Building 4012.[11,12]

Former Use(s): Building 4012 was a SNAP Critical Test Facility. Operations began in 1962 with experiments using three SNAP critical assemblies (SCA-4A, SCA-4B, and SCA-5). Clad reactor fuel elements (U-ZrH) were stored in the fuel storage tubes located in Room 109. The SNAP critical experiments continued intermittently through 1968, when the fuel was shipped to the Source and Special Nuclear Material Storage Vault (Building 4064) and the facility was placed in stand-by mode. Additional critical experiments for the NASA-sponsored Heavy Metal Reflected Fast Spectrum Reactor (HMRFSR) project occurred from 1970 to 1972. In 1979, the concrete portion of the facility was modified for use by Energy Technology Engineering Center (ETEC) Quality Assurance in performance of x-ray machine and source radiography. The major

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[1] Oliver, B.M., *Final Radiological Survey Report for Building T012,ETEC No. 012-AR-0002*, Energy Technology Engineering Center, June 14, 1996, p. 7.

[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.

[3] Ashley, R.L. et al., *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities, NAA-SR-7300*, Atomics International, May 25, 1962, pgs. V-8 –V-10.

[4] Vitkus, T.J. and Morton, J.R., *Verification Survey of Building T012 Santa Susana Field Laboratory, Rockwell International, Ventura County, California,* Oak Ridge Institute for Science and Education, October 1996, p. 3.

[5] Pascolla, A.L., *Decontamination and Decommissioning of Building T012, ETEC No. 012-AR-0001*, Boeing North American Inc., Rocketdyne Division, May 8, 1997, pgs. 3, 8.

[6] Federal Register Vol. 62, No. 195, *Certification of the Radiological Condition of Building T012 at the Energy Technology Engineering Center Near Chatsworth, California*, U.S. Department of Energy, Office of Environmental Restoration, October 8, 1997, pgs. 52528-52529.

[7] Gavigan, F. X. et al., *Reactor Safety Survey Report, SNAP Critical Assembly -5 (SCA-5), Building 012*, February 23, 1965, pgs. 10-11.

[8] Unknown Author, *Facility Information, Building No. 012*, Unknown Date, HDMSP001828011.

[9] Internal Correspondence from Heine, W.F. to Remley, M.E., North American Rockwell, *Reference: Operational Safety and Waste Management Unit Weekly Highlights – Week Ending May 5, 1973*, May 11, 1973, p. 2.

[10] Begley, F.E., Radiation Survey of Building 012, SCTI Cogeneration Project, Rockwell International, Rocketdyne Division, May 30, 1985, p. 3.

[11] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-30.

[12] *Santa Susana Field Laboratory Site Development Plan, Existing Development, Sanitary Sewage System*, Rockwell International Corporation, Unknown date, HDMSE00688360.

modification involved removal of four fuel storage tubes and enclosure of the fuel storage room to serve as a radiographic darkroom. This use was terminated in 1992 and all radioactive sources were transferred to the Radioactive Material Handling Facility (RMHF) for storage.[1]

Decontamination and decommissioning was performed in two phases. In 1986, the unattached operations and control building and the connecting walkway that were considered part of the Building 4012 complex were demolished in order to build the SCTI Power Pak section of the Co-Generation Project. The remaining concrete vault portion of the facility (Room 109 and 110) served as a structural support foundation for the Co-Generation Unit. Final decontamination and decommissioning of the remaining portion of the building was performed from February through June 1995.[2,3]

Information from Interviewees: A number of former employees were interviewed about their experience at the Santa Susana Field Laboratory. Two remembered specific information about Building 4012. An excerpt from this interview is included below.

Interviewee 107 was an engineer at Atomics International from 1961 to 1973 and worked on the SNAP 2, SNAP 10/10A, and S8ER programs. The following excerpts were pulled from the interview.

> *"I was an alternate engineer in the Building 12 critical facility, where all of the free plutonium in the world was located at one point."*[4]

Interviewee 255 was an atomic reactor inspector and x-ray technician at the Santa Susana Field Laboratory from 1967 to 1985. The following excerpts were pulled from the interview.

> *"Building 4012 was a reactor building that had some radiation in it at one time. It was cleaned up and we used it for an x-ray lab in later years when I was an x-ray technician. The walls in Building 4012 were 3 feet thick. If I was going to be x-raying in Building 4012 with cobalt or a 350 KV x-ray machine, I had to call security first so they would adjust the radiation monitors that were across the road and down the hill."*[5]

Radiological Incident Reports: None found.

Current Use: Demolished in 2003.[6] Based on available information, the dimensions of the excavation made during building demolition are unknown.

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[1] Pascolla, A.L., *Decontamination and Decommissioning of Building T012, ETEC No. 012-AR-0001*, Boeing North American Inc., Rocketdyne Division, May 8, 1997, pgs. 3-4, 10-11.
[2] Pascolla, A.L., *Decontamination and Decommissioning of Building T012, ETEC No. 012-AR-0001,* Boeing North American Inc., Rocketdyne Division, May 8, 1997, pgs. 3-4, 10-11.
[3] Federal Register Vol. 62, No. 195, *Certification of the Radiological Condition of Building T012 at the Energy Technology Engineering Center Near Chatsworth, California,* U.S. Department of Energy, Office of Environmental Restoration, October 8, 1997, p. 52529.
[4] Interview No. 8 conducted by DOE and EPA on July 14, 2010.
[5] Interview No. 255 conducted by DOE and EPA Joint Interview on July 9, 2010.
[6] The Boeing Company, Rocketdyne Propulsion & Power, *Site Environmental Report for Calendar Year 2003 DOE Operations at The Boeing Company Rocketdyne Propulsion & Power, RD04-170*, September 2004, p. 5-13.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): A chronology of radiological investigations at this building is as follows:

- **1973 Building Decontamination and 1979 Radiation Survey**. Building 4012 was decontaminated and surveyed during the period March through May 1973. Fixed contamination was painted over with an eggshell-colored paint and stenciled "Caution Fixed Alpha Radioactive Material." The holdup tank was also removed in 1973. In 1979, a follow-up radiation survey was performed identifying areas with alpha activity at or below the limit for uranium.[1]

- **1985 Rocketdyne Radiological Survey**. In 1985, a comprehensive radiological survey indicated the presence of alpha contamination in both Rooms 109 and 110 of the concrete vault. The equipment area of Room 109 exhibited alpha contamination at the entrance door (840-1,400 disintegrations per minute per 100 square centimeters (dpm/100 cm^2)), overhead light fixtures (2,800 dpm/100 cm^2), air conditioning duct (840-2,800 dpm/100 cm^2), radioactive exhaust duct (4,200 dpm/100 cm^2), and steel door frame between Rooms 109 and 110 (1,960 dpm/100 cm^2). Spot checks of the concrete floor surface under the floor tile revealed contamination levels of 1,400-2,800 dpm/100 cm^2). All of these are below the allowable limit for surface contamination, which is 5,000 dpm/100 cm^2). Survey of the fuel storage area of Room 109 revealed contamination of the concrete floor (up to 6,500 dpm/100 cm^2). Survey of the fuel storage tubes indicated contamination levels up to 6,000 dpm/100 cm^2) at the entrance of the tubes. Eight contaminated fuel storage tubes were identified and removed. The walls, ceiling, and floor of the critical cell (Room 110) were covered with paint, which prevented meaningful alpha surveying. However, the walls were stencil painted "CAUTION, FIXED ALPHA RADIOACTIVE MATERIAL." Contamination was indicated on the light fixtures (2,800 dpm/100 cm^2) and electrical boxes 280-840 dpm/100 cm^2). To allow the release of Building 4012, radioactive materials and hazards were removed from the building.[2]

- **1996 Rockwell Final Radiological Survey**. Rockwell/Rocketdyne performed a final radiological survey in 1996. Survey results indicated that Building 4012 was suitable for release without radiological restrictions in 1996.[3] Acceptable contamination limits and gamma exposure rates for releasing a facility for unrestricted use are prescribed in the U.S. Department of Energy (DOE), the U.S. Nuclear Regulatory Commission (NRC), and the State of California guidelines. The lowest, most conservative limits were chosen from these guidelines and incorporated into the final survey criteria for Building 4012. The surface contamination limits for alpha and beta were excerpted from DOE Order 5400.5 and NRC Regulatory Guide 1.86 (see table below). The ambient gamma exposure rate limits at 1 meter were excerpted from an NRC Dismantling Order because

[1] Pascolla, A.L., *Decontamination and Decommissioning of Building T012, ETEC No. 012-AR-0001*, Boeing North American Inc., Rocketdyne Division, May 8, 1997, pgs. 3-4, 10-11.
[2] Pascolla, A.L., *Decontamination and Decommissioning of Building T012, ETEC No. 012-AR-0001*, Boeing North American Inc., Rocketdyne Division, May 8, 1997, pgs. 3-4, 10-11.
[3] Federal Register Vol. 62, No. 195, *Certification of the Radiological Condition of Building T012 at the Energy Technology Engineering Center Near Chatsworth, California*, U.S. Department of Energy, Office of Environmental Restoration, October 8, 1997, p. 52529.

at 5 microroentgens per hour (μR/hr) it was more conservative than the DOE value of 20 μR/hr, and more consistent with as low as reasonably achievable principles.[1,2]

Surface Contamination Guidelines from
DOE Order 5400.5 (1990) and NRC Regulatory Guide 1.86 (1974)

Allowable Total Residual Surface Contamination (dpm/100 cm^2)			
Radionuclides	**Average**	**Maximum**	**Removable**
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, and I-129	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, and I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000β-γ	15,000β-γ	1,000β-γ
External Gamma Radiation			
The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restriction on its use shall not exceed the background level by more than 20 μR/h.			

Source: U.S. Atomic Energy Commission (now NRC) Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, June 1974, p. 1.86-5.
U.S. Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment, February 8, 1990, p. IV-6.

- **1996 ORISE Verification Survey**. In July 1996, the Oak Ridge Institute for Science and Education (ORISE) performed a verification survey of Building 4012. ORISE's finding support Rockwell's final status survey that the radiological conditions of Building 4012 met DOE guidelines for unrestricted release in 1996. Residual radioactive material guidelines from DOE Order 5400.5 are summarized in Table 1 above. The DOE's exposure rate guideline is 20 microroentgens per hour (μR/h) above background; however, Rockwell elected to use a more restrictive guideline of 5 μR/h above background level. The total alpha surface activity ranged from less than 34 to 170 dpm/100cm^2 in soil. The total beta surface activity ranged from less than 230 to 480 dpm/100cm^2 in soil. The removable activity was less than 9 dpm/100cm^2 for gross alpha and less than 15 dpm/100cm^2 for gross beta. The Rockwell-determined average background exposure rate was 14 μR/hr and ORISE observed rates ranged from 12 to 15μR/hr.[3]

[1] Oliver, B.M., *Final Radiological Survey Report for Building T012,ETEC No. 012-AR-0002*, Energy Technology Engineering Center, June 14, 1996, p. 19.
[2] Rash, M., *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-012, T-029, and T-363*, Tetra Tech EM, Inc., December 20, 2002, pgs. 2-3.
[3] Vitkus, T.J. and Morton, J.R., *Verification Survey of Building T012 Santa Susana Field Laboratory, Rockwell International, Ventura County, California,* Oak Ridge Institute for Science and Education, October 1996, pgs. 4,6-8, C-1.

- **1996 California DHS Confirmatory Survey**. On July 31, 1996, the California Department of Health Services (DHS), Radiologic Health Branch (RHB) completed a confirmatory survey of Building 4012.[1]

- **1997 Release Without Radiological Controls**. On October 16, 1997, the DOE granted approval for the release of Building 4012 without radiological controls.[2]
- **1997 Concurrent on Unrestricted Release**. On November 26, 1997, the California DHS, RHB stated it concurred with the assessment that Building 4012 may be released without radiological restrictions.[3]

- **2001 EPA Verification Survey**. In 2001, an independent oversight verification and confirmation survey funded by the Environmental Protection Agency (EPA) was conducted to compare results against previous surveys by Rocketdyne and ORISE. The 2001 survey showed good agreement with prior surveys and results below NRC radiological limits in 2001. See table above.[4]

Radiological Use Authorizations: Use Authorization No. 026 allowed for the operation of a neutron generator in Building 4012.[5] Use Authorization No. 165 pertained to the surveillance of Building 4012.[6]

Former Radiological Burial or Disposal Locations: Contaminated items were generally placed in cardboard "ice cream" cartons, tagged for identification, and placed in collection bins outside the facility.[7]

Fuel powder and waste material were generated in the fume hood during fuel handling operations and stored in a radioactive trash barrel. An estimated 1 gram of uranium-235 (U-235) was present for every cubic foot of trash. Periodically, the contents of this barrel were sent to the RMHF for burial or recovery.[8]

Aerial Photographs: Building 4012 is first identified in a 1965 aerial photograph. It was located just south of an escarpment. Aerial photographs from 1965 and 1967 indicate an access road and disturbed ground north of Building 4012 in Subarea HSA-7. In 1967, the southwest portion of the disturbed ground area, north of and between Buildings 4013 and 4019, contains possible liquid waste. By 1972, the disturbed ground is re-vegetated, but ground scarring

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[1] Correspondence from Wong, G., Department of Health Services, Radiologic Health Branch, to Barnes, J., Boeing North America, Inc., *Reference: Boeing's Request for Concurrence in Release for Use Without Radiological Restriction, Rocketdyne Santa Susana Field Laboratory, Building T012*, dated November 26, 1997.
[2] U.S. Department of Energy, Oakland Operations Office, Environmental Restoration, *Certification Docket for the Release of Building T012 at ETEC, DOE/CD-ETEC-012*, November 26, 1997, p. 5.
[3] Vitkus, T.J. and Morton, J.R., *Verification Survey of Building T012 Santa Susana Field Laboratory, Rockwell International, Ventura County, California,* Oak Ridge Institute for Science and Education, October 1996, pgs. 4,8.
[4] Rash, M., *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-012, T-029, and T-363*, Tetra Tech EM, Inc., December 20, 2002, pgs. 1, 35.
[5] Review of Radiation Safety Records Management System, 2010.
[6] Radiation Safety Records Management System Index, The Boeing Company, Reviewed November 8, 2010.
[7] Gavigan, F. X. et al., *Reactor Safety Survey Report, SNAP Critical Assembly -5 (SCA-5), Building 012*, February 23, 1965, pgs. 10-11.
[8] Internal Correspondence from Heneveld, W.H. to Schaubert, V.J., North American Rockwell, *Reference: SS Material Control for Bldg 012*, March 30, 1971, pgs. 3-4.

continues to be noted in aerial photographs through 2005 where the area is the subject of earth moving activity. In 1978, an open storage (OS) area, identified as OS-7, and a possible waste disposal area (WDA), identified as WDA-6, are visible north of Building 4012. A probable stain was located at the west end of OS-7. Possible solid waste debris is noted in WDA-6. By 1988, Building 4228, the new SCTI Power Pak facility, has been constructed on top of Building 4012 and a structure containing cooling fans (Building 4710) is visible to the east of Buildings 4012 and 4228. An overhead pipe is also noted near the southwest corner of Building 4228. In 1995, overhead pipes, a vertical tank, and a probable stain are identified around Building 4012 and the cooling fan structure. A stain near the south end of the cooling fan structure is also noted. By 2005, all the structures associated with Building 4012 were gone.[1]

Radionuclides of Concern: Clad reactor fuel elements (uranium zirconium hydride (U-ZrH)) were stored in the fuel storage tubes located in Room 109.[2] Radiographic sources were also stored here.[3] Radionuclides resulting from reactor operations in Building 4012 include: americium (Am-241), cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[4] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: The general slope of Area IV, including Building 4012, is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling. The north end of Building 4012 is near the surface drainage divide for the area. North of the drainage divide, water drains northerly to Simi Valley.[5,6] Aerial photographs from 1957 to 2005 indicate that drainage followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[7] The 17th Street Drainage is discussed later in this section.

Radiological Contamination Potential: Class 1 because of former use of Building 4012.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Pascolla, A.L., *Decontamination and Decommissioning of Building T012, ETEC No. 012-AR-0001*, Boeing North American Inc., Rocketdyne Division, May 8, 1997, pgs. 3-4, 10-11.
[3] Tuttle, R.J., Listing of Locations in SSFL Area IV Associated with Radioactive Materials, September 1989, p. 5.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[7] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

Recommended Locations for Sediment/Soil Sampling:

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

Extensive soil sampling is recommended in the Building 4012 area. As discussed above, 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. 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 Administrative Order on Consent. 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 south 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 and possible WDA-6 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.

2.1.3 Building 4013 Area

Site Description: The Building 4013 area comprises Building 4013, Electrical Substation 4713, Time Clock 4823, Uninterruptible Power Supply (UPS) Building 4413, and the land surrounding these buildings. Building 4013 was constructed in 1962 as a non-nuclear Systems for Nuclear Auxiliary Power (SNAP) component assembly and performance testing building. A paved area northwest of the building was used for equipment staging. Building 4013 was situated near the northwest property line of Area IV. The terrain near the northern property line is very rugged and there is a 40-foot drop in elevation.[1,1,2] Figures 2.1.3a through 2.1.3i provide a current

[1] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 10.

photograph and the best available building-specific drawing(s) and photos that the research team could find. Building 4013 was located between SNAP Critical Test Facility Buildings 4012 and 4019. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4013 was constructed with a steel frame and siding. It had a 33-foot high bay with a 5-ton bridge crane and a 15-foot low bay. The building had a total area of 8,370 square feet. Ten aboveground tanks were associated with Building 4013, nine 6,000-cubic-feet gaseous nitrogen tanks, and one 250-gallon diesel oil tank. Building 4013 had restrooms and was attached to the site sewer system that runs south of the building.[3,4,5,6] Figure 2.1.3b provides a floor plan of Building 4013. Five as-built drawings for Building 4013 are included in this section. Figure 2.1.3c is an as-built plot plan, Figure 2.1.3d is an as-built foundation plan, Figure 2.1.3e is an as-built elevation and roof plan, Figure 2.1.3f is an as-built floor plan, and Figure 2.1.3g is an as-built reactor development equipment list plan.

Former Use(s): Building 4013 was a non-nuclear component assembly and performance test building supporting the SNAP program. Assembly and checkout of the following SNAP units were accomplished in the 1960s at Building 4013: PSM-1, PSM-3, PSM-1A, FSEM-2, PSM-1B, FSM-1, FSEM-2A, FS-3, FSM-4, FS-4, and FS-5. Figure 2.1.3f depicts the assembly and support areas including: the general assembly area, electronic assembly area, "T/C" assembly area with x-ray booth, mechanical area, shop support area with welding booth, and receiving and holdup area. In 1970, Building 4013 was re-designated as the Energy Technology Engineering Center Thermal Transient Facility. Half of the high bay was used for thermal testing since that time and the other half was used for seismic test equipment.[7] Authorization for building modifications and improvements to support SNAP programs was also granted in 1970. Improvements included installation of new partitions, floor tile, ceilings, doors, air conditioning equipment, ducting, utilities, diffusers and equipment pads for clean room and low bay cooling requirements, and a new paint job.[8]

Information from Interviewees: None to date.

Radiological Incident Reports: There has been one incident associated with Building 4013. The following table provides information presented in an incidents database provided by Boeing.

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-11.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.
[3] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-30, b-41, b-45.
[4] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 10, 17, 20, 24.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-11.
[6] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-23, b-41, b-45.
[7] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 2, 10, 17, 20, 24, 92.
[8] Correspondence from Pollman, A.P., U.S. Atomic Energy Commission, to Petersen, R.C., Atomics International, *Reference: Building 013 Modifications and Improvements, SNAP, Contract AT(04-3)-701*, dated October 16, 1970.

Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4013 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0369	4/9/1963	X-RAY BOOTH		INVESTIGATION OF POSSIBLE OVEREXPOSURE APPEARS TO BE A MEDICAL EXPOSURE.

Current Use: Demolished in July 2003.[1] Based on available information, the dimensions of the excavation made during building demolition are unknown. Figures 2.1.3h and 2.1.3i show photographs of Building 4013 before and after demolition.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): A chronology of radiological investigations at this building is as follows:

- **1988 Rockwell Final Status Survey**. In 1988, Rockwell/Rocketdyne performed a final status survey of Building 4013 along with Building 4019 and two adjacent areas to determine if any radioactive material remained that required further surveying or decontamination. A walk-through survey for gamma exposure rates was performed and measurements were made at 75 locations inside Building 4013. The average gamma exposure rate was 6.8 microroentgens per hour (µR/hr). This was reported as considerably lower than the outdoor "natural background" levels ranging between 14 and 16 µR/hr. The survey concluded that none of the areas were contaminated with residual radioactivity. Acceptable limits adopted by Rocketdyne for this survey were based on enriched uranium used for SNAP programs. The maximum acceptable contamination limit for total surface area averaged over 1 square meter (m^2) was 5,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2) for alpha and beta contamination. The maximum allowable contamination for a single area not more than 100 cm^2 in that 1 m^2 was 15,000 dpm/100 cm^2 for alpha and beta contamination. The removable surface contamination limit was based on a surface wipe over 100 cm^2 and was 1,000 dpm/100 cm^2 for alpha and beta contamination. Ambient gamma exposure limits were based on the U.S. Nuclear Regulatory Commission limit of 5 microroentgens per hour above background.[2]

- **1995 ORISE Verification Survey**. In 1995, the Oak Ridge Institute for Science and Education (ORISE) performed a verification survey to validate the final status survey performed by Rockwell/Rocketdyne for Building 4013. Survey tasks included document reviews, surface scans, surface activity measurements, exposure rate measurements, and soil sampling. Deficiencies were noted in Rockwell/Rocketdyne's final status documentation and recommendations for revision were provided. Total surface activity

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-11.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 10, 17, 20, 24, 28-29, 64-65.

levels in Building 4013 were less than 55 dpm/100 cm^2 for alpha contamination and less than 1,400 dpm/100 cm^2 for beta contamination. Removable activity levels were less than 12 dpm/100 cm^2 for gross alpha and less than 16 dpm/100 cm^2 for gross beta. Exposure rates inside Building 4013 ranged from 8 to 11 μR/hr while background exterior exposure rates ranged from 12 to 16 μR/hr and averaged 14 μR/hr. Soil samples taken in the storage area northwest of Building 4013 are described in the table below. Other than the U.S. Department of Energy's (DOE) generic residual soil concentration guidelines for thorium and radium of 5 picocuries per gram (pCi/g) in the first 15 centimeters of soil and 15 pCi/g in thick layers of subsurface soil, guidelines for other radionuclides are developed on a site-specific basis. There were no approved site-wide guidelines at the Santa Susana Field Laboratory for the other radionuclides of concern. As a result, this survey compared radionuclide concentrations in soils to background concentration levels. ORISE's verification results showed surface activity levels and exposure rates were less than DOE and U.S. Nuclear Regulatory Commission (NRC) guidelines for release to unrestricted use in 1995 (see surface contamination guideline table below). Radionuclide concentrations in soil were comparable to background concentrations.[1,2]

Radionuclide Concentrations Found in Northwest Area Soil Samples

Radionuclide Concentrations (pCi/g)		
Radionuclide	**Samples Collected**	**Background**
Cs-137	<0.1 to 0.5	<0.1 to 0.2
Ra-226	0.8 to 1.0	<0.2 to 1.2
Th-228	1.2 to 1.5	0.6 to 1.4
Th-232	1.5 to 1.7	0.6 to 1.7
U-235	<0.1	<0.1
U-238	<1.5 to 1.9	<2.2 to 2.5

[1] Vitkus, T.J. and Bright, T.L., *Verification Survey of the Interim Storage Facility: Buildings T030, T641, and T013; An Area Northwest of Buildings T019, T013, T012, and T029 and a Storage Yard West of Buildings T626 and T038, Santa Susana Field Laboratory, Rockwell International, Ventura County, California, ORISE 96/C-4*, Oak Ridge Institute for Science and Education, February 1996, pgs. 6,-15, 30, C-1–C-2.
[2] Correspondence from Vitkus, T.J., Oak Ridge Institute for Science and Education, to Williams, D., U.S. Department of Energy, *Reference: Comments on the Final Status Survey Documentation for the Interim Storage Facility; Building T013, T019, T024, T030, and T641; the Storage Yard West of Buildings T626 and T038; and the NW Area; Santa Susana Field Laboratory, Ventura County California*, January 11, 1966.

**Surface Contamination Guidelines from
DOE Order 5400.5 (1990) and NRC Regulatory Guide 1.86 (1974)**

Allowable Total Residual Surface Contamination (dpm/100 cm^2)			
Radionuclides	**Average**	**Maximum**	**Removable**
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, and I-129	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, and I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000β-γ	15,000β-γ	1,000β-γ
External Gamma Radiation			
The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restriction on its use shall not exceed the background level by more than 20 µR/h.			

Source: U.S. Atomic Energy Commission (now NRC) Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, June 1974, p. 1.86-5.
U.S. Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment, February 8, 1990, p. IV-6.

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4013 is first identified on a 1965 aerial photograph. It was located just south of an escarpment. A 1967 aerial photograph identifies probable leakage emanating from an unidentified object located at the northwest corner of Building 4013 and draining southwest between Buildings 4013 and 4019 to 20th Street. A 1972 aerial photograph notes an open storage area north of Building 4013. By 1980, five probable horizontal tanks are identified north of Building 4013. In 1988, eight probable horizontal tanks and one known horizontal tank are located north of the building. In 1995, eight horizontal tanks and an overhead pipe are noted north of the building. By 2005, Building 4013 has been demolished.[1]

Radionuclides of Concern: The research team found no evidence that nuclear or radioactive materials were known to have been handled in Building 4013.[2] Radionuclides associated with the potential migration from SNAP Buildings 4012 and 4019 include: americium (Am-241), , cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[3,1] All radionuclides of concern

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 10, 17, 20, 24.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.

listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Storm drainage for Building 4013 follows a culvert southwest of the building to 20th Street.[2] Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[3] The general slope of Area IV, including Building 4013, is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling. The north end of Building 4013 is near the surface drainage divide for the area. North of drainage divide, water drains northerly to Simi Valley.[4,5] Building 4013 was located west of SNAP Critical Facility Building 4012 and may have received drainage from Building 4012. Building 4013 is attached to the site sewer system.

Radiological Contamination Potential: Class 1 due to potential radioactive material migration via surface water flow or airborne release from SNAP Critical Test Facility Buildings 4012 and 4019.

Recommended Locations for Sediment/Soil Sampling:

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

Extensive soil sampling is recommended in the Building 4013 area. Building 4013 is located between SNAP Critical Test Facility Buildings 4012 and 4019. Consequently, potential radioactive material migration via surface water flow or airborne release from these facilities may affect Building 4013. Significant information is lacking regarding the excavation activities at Building 4013. In addition, previous characterization studies for the Building 4013 area were focused on delineating the extent of contamination to standards that were applicable at the time. Previous characterization studies for the Building 4013 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 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4013 area. This includes the following Building 4013 areas:

- The area between the Building 4013 and Building 4012 footprints. Radionuclides originating from Building 4012 may have migrated to the area between buildings via surface water flow or airborne releases.

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1 Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853462.
2 *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
3 Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
4 Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
5 Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- The area between the Building 4013 footprint and Building 4019. Radionuclides originating from Building 4019 may have migrated to the area between buildings via surface water flow or airborne releases.

- Sanitary sewer line south of the Building 4013 footprint. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Northwest corner of the Building 4013 footprint and area between Building 4013 footprint and Building 4019 where leakage from unknown source was noted in aerial photographs.

- Area north of the Building 4013 footprint where aerial photographs note storage tanks of unknown content.

- Drainage pathways associated with the Building 4013 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.1.4 Building 4019 Area

Site Description: The Building 4019 area comprised Building 4019, Electrical Substation 4719, and the land surrounding these two buildings. Building 4019 was constructed in 1962 as the Systems for Nuclear Auxiliary Power (SNAP) Flight Systems Nuclear Qualification Test Building located near the northwest property line of Area IV. Building 4019 is serviced by Electrical Substation 4719.[1] The building sits on a paved yard of asphalt concrete that extends 90 feet to the north. This yard was used for equipment staging and gas tanks.[2] Building 4019 is located between SNAP Buildings 4013 and 4059. Figures 2.1.4a through 2.1.4h provide a current photograph and the best available building-specific drawing(s) that the research team could find. Building 4013, a non-nuclear SNAP component assembly building, is discussed elsewhere in this section. SNAP 8 Development Reactor Building 4059 are discussed in the Subarea HSA-5C TM. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4019 sits on a concrete slab and has a steel frame, roof, and sides. It has a total area of 6,402 square feet. Building 4019 contains a high bay and a low-bay office-control center. The high bay is 60 feet long, 45 feet wide, and 36 feet high and contains a 10-ton crane, below-grade test cell with hydraulic lift, and an 8-foot vacuum test chamber.[3] The low bay is 60 feet long, 28 feet wide, and 10 feet high and contains the control room, personnel change room, equipment room, and offices.[4,1] Building 4019 has restrooms and air

[1] DE-AC03-98SF21530, *Environmental Restoration and Remediation of the Former Energy Technology Engineering Center*, Contract Awarded to Boeing North American, Inc., Rocketdyne Propulsion & Power, December 31, 1998, Attachment 1, Appendix 2, p. 2.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 10, 17, 24.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[4] Liddy, P., *Building 4019 Final Status Survey Report*, The Boeing Company, June 10, 1999, p. 7.

conditioning.[2] A vault (Room 109) is located in the southeast corner of the high bay measuring 12 feet long, 10 feet wide, and 10 feet high. It was originally built with cinder block walls for nuclear fuel element storage. The reactor test chamber in the high bay floor is 12 feet in diameter and 40 feet deep.[3,4]

A description of auxiliary systems in Building 4019 included a liquid radioactive waste system that involved accumulating waste from the vault sump and the change room sink and floor drain in the radioactive waste holdup tank.[5] The as-built plumbing plan identifies floor drains, pumps, and tanks. In 1964, the plumbing plan indicates that a circulating pump and sump pump were added to the vault underneath the change room (Room 107). The circulating pump was part of a waste survey tank (radioactive waste holdup tank) that was connected to the sump pump and change room shower drain. In 1973, three floor drains in the change room and two floor drains in the control room were deactivated, and the shower and lavatory in the change room were removed.[6] In 1993, the waste survey tank was found deteriorated and partially submerged in water that filled the tank vault. Possible sources of the water included the emergency safety shower adjacent to the vault, rainwater runoff, or percolation of groundwater through the containment wall. The tank was estimated to have a capacity of 500 gallons.[7] The vault water and tank contents were analyzed for radiological and chemical contamination and none was found.[8] The tank removal plan called for removing the tank and associated piping, sealing a 4-inch open sewer main, backfilling the vault space, and capping the vault with a concrete slab.[9]

A 300-gallon aboveground deionized water tank was associated with Building 4019. A sanitary sewer line is identified forming a "T" directly south of Building 4019.[10]

Figure 2.1.4b provides a floor plan of Building 4019. Six as-built drawings for Building 4019 are also included in this section. Figure 2.1.4c is an as-built plot plan, Figure 2.1.4d is an as-built foundation plan, Figure 2.1.4e is an as-built floor plan, Figure 2.1.4f is an as-built section drawing, Figure 2.1.4g is an as-built heat, ventilation, and air conditioning section drawing, and Figure 2.1.4h is an as-built plumbing plan for Building 4019.

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[1] Jaquay, K., *Final Report Decontamination and Dismantlement Operations at SSFL Building 4019 for Release Without Radiological Restrictions*, The Boeing Company, September 11, 1999, p. 16.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-30.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[4] Liddy, P., *Building 4019 Final Status Survey Report*, The Boeing Company, June 10, 1999, p. 7.
[5] Operating Limits, SNAP 10 A Flight Systems in the Acceptance Test Facility (Building 019), Enclosure to 64AT-6960, p. 6.
[6] Norman Engineering Co., *Building 019, SNAP Flight Systems Prototype, Nuclear Test Facility, Plumbing Plans and Details, 303-019-M3, Rev. 7*, September 8, 1961.
[7] Internal correspondence from Ingersoll, R.D. to DeBear, W.S., Rockwell International, *Reference: Notification – Unreported Underground Tank, Rocketdyne Facilities Engineering Environmental Tasks*, dated December 22, 1993.
[8] Internal correspondence from Lenox, A.J. to Ingersoll, R., Rockwell International, *Reference: Building 19 Underground Storage Tank*, dated July 12, 1994.
[9] Internal correspondence from Ingersoll, R.D., Rockwell to Gaylord, G.G., Rockwell International, *Reference: Removal Plan - Underground Water Storage Tank, Building 019*, dated October 13, 1994.
[10] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-23, b-41, b-45.

Former Use(s): Building 4019 was built to conduct criticality acceptance tests of SNAP reactors before they were delivered to the Atomic Energy Commission for launch as space power systems. The criticality tests of the S10FS3 reactor were conducted in Building 4019 in 1963 before the reactor was operated in the SNAP Environmental Test Facility (Building 4024).[1] In 1964 and 1965, three SNAP 10A flight systems, FS-1, FS-4, and FS-5, were assembled and tested in Building 4019. The total time spent by any flight system in Building 4019 was less than four months, and the reactor operation was less than 16 hours total for any flight system. Radiation exposure to the test facility was reported to be minor.[2] According to The Boeing Company, all nuclear materials were removed from the building when the last SNAP reactor was removed in 1965 and the facility was used for other purposes during the 1970s and 1980s.[3] However, a 1968 letter indicates that fissile materials were being stored in Building 4019.[4] According to the U.S. Nuclear Regulatory Commission (NRC), fissile material is any "nuclide that is capable of undergoing fission after capturing low-energy thermal (slow) neutrons." This current definition means the "three primary fissile materials are uranium-233, uranium-235, and plutonium-239. This definition excludes natural and depleted uranium that has not been irradiated, or has only been irradiated in thermal reactors."[5] Upon termination of the SNAP program in 1970, all SNAP components were removed. Building 4019 was re-designated the Energy Technology Engineering Center (ETEC) Construction Staging and Computer Facility.[6]

Information from Interviewees: A number of former employees were interviewed about their experience at the SSFL. Two remembered Building 4019. Excerpts from these interviews are included below.

Interviewee 195 started working in Area IV on the hill in 1968 at the Building 355 and later went into other buildings like Building 19, Building 4013, Building 59, and the infamous sodium burn pit. The following excerpt was pulled from the interview.

> *"Also I worked in Building 19 where they built the "snubbers"—shock absorbers —great big rubber donuts that they put under pavement for earthquakes. This work was done for the highway commission. When they cleaned up Building 19 they had a lot of hydraulic lines."*[7]

Interviewee 427 worked for Atomics International beginning in June 1957 and was initially assigned as a test engineer to the pyroprocessing refabrication experiment and later went on to work on zirconium hydride reactor systems at the Santa Susana Field Laboratory. The following excerpts were pulled from the interview.

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[1] The Boeing Company, Rocketdyne Environmental Affairs, *Building 4019 – SNAP Flight System Critical Facility*, January 8, 2003, p. 1.
[2] Jaquay, K., *Final Report Decontamination and Dismantlement Operations at SSFL Building 4019 for Release Without Radiological Restrictions*, The Boeing Company, September 11, 1999, pgs. 16, 19.
[3] The Boeing Company, Rocketdyne Environmental Affairs, *Building 4019 – SNAP Flight System Critical Facility*, January 8, 2003, p. 1.
[4] Internal correspondence from Bunch, D.F. to Alexander, R.E., Atomics International, a Division of North American Aviation, Inc., *Reference: Emergency Preparedness Meeting with SAN Personnel*, dated January 25, 1968.
[5] "Fissile Material," U.S. Nuclear Regulatory Commission, http://www.nrc.gov/reading-rm/basic-ref/glossary/fissile-material.html (August 2, 2010).
[6] Liddy, P., *Building 4019 Final Status Survey Report*, The Boeing Company, June 10, 1999, p. 7.
[7] Interview No. 195 conducted by DOE in 2010.

"I was involved with nuclear acceptance testing prior to mating the SNAP 10A to a launch vehicle. The first Flight System (FS-1) was tested quite thoroughly to see if it was acceptable for launch vehicle integration, for launch, and for orbital startup. It was installed in an underground vacuum chamber in Building 19 and had a nuclear fuel loading in the core. The system had to be raised to operating temperatures by heating the return piping. In the process of running the test, NaK leaked into the vacuum chamber from a failed expansion compensator. The vacuum chamber was then filled with inert argon to enable removing the system to determine where the failure had occurred and what repairs could be made.

The firemen started spraying the smoking NaK with their hose to try to keep it cold! A very, very wrong thing to do with liquid NaK. Instead, they started a real uncontrollable fire. Normally, we would throw chemicals on the NaK liquid to slow down the reaction until the liquid could be scoped up and put into a safe container. The firemen didn't know the right NaK fire fighting procedures or the proper procedures for containment of spilled NaK. At that moment, FS-1 could not be repaired and became unusable scrap!

The DOE representative had a sidekick, RTV, who said it was an act of sabotage, but it was really a design flaw in the expansion compensator, which were small thin metal bellows that required many difficult welds. The multiple welds weakened the bellows which caused the failure, and that's why FS-1 was scrapped. The nuclear fuel was removed and returned to safe storage.

Flight System 4 (FS-4) became the launch system and we repeated the process with a revised container around the bellows so that if the NaK leaked, it would be contained.

The test was re-done, the temperature was increased but could only go up to operating temperature a few times because the resistance heaters had a finite life. The first time the system temperature was increased, the converter shorted out and produced no electricity. Analytical tests were performed and people from DeSoto were involved and they couldn't find the failure (i.e., the short). It shorted when the temperature went up and came back when the temperature went down. The launch date was less than one month away so what do we do?

I got on a ladder and sat on the top of the vacuum chamber and looked through the little windows to see if I could see a spark and find where the short was located. A second person also looked for the spark, and we both found it in the exact same spot, (on top of the converter in the space between the radiator and the structure). We removed the vacuum chamber and placed a ladder against the radiation shield and found the arcing spot. Because we had a launch date coming up, we fixed the short ourselves by cutting off a small insignificant part of the converter radiator. Then we completed the test and shipped FS-4 off to the launch site to be launched on 13:24 PST on 3 April 1965. -----FS-4 became an American Legacy!" [1]

[1] Interview No. 427 conducted by DOE in 2010.

Radiological Incident Reports: There has been one incident associated with Building 4019. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4019 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0304	4/10/1976	LARGE TANK	Ir-192	STUCK GAMMAGRAPH SOURCE UNCOUPLED BY UNBADGED OPERATOR.

- According to a 1988 Rockwell report, no major contamination incidents are known to have occurred in Building 4019. No fission product releases occurred and facility activation by neutrons was negligible.[1]

In addition to the incidents listed in Boeing's database, the following sodium potassium (NaK) incidents were noted in a 1964 log book.

- On June 23, 1964, a NaK leak detector alarm went off while testing SNAP 10AFSI. The following day, NaK was noticed inside the vacuum chamber, with the highest concentration of NaK around the instrument compartment. On June 25, 1964, the "vacuum chamber center section was raised above floor level…to observe NaK from the spill." The next day the SNAP 10 FSI unit was out of the vacuum center section, approximately 6 feet above the high bay floor. People were taking pictures, but only one was wearing the proper NaK protective clothing.[2]

- On June 29, 1964, a NaK fire was observed inside the "A.P.V." of Building 4019. According to a log book, "the NaK fire looked quite large and close to out of control. 3 or 4 metal-X extinguishers were emptied before control was attained." A large amount of NaK was pouring out of the instrument compartment and a fireman on duty assumed it was coming from the "Rx coolant system." The expansion compensater, which was discovered to be the source of the NaK leak, was cut out of the "Rx coolant system." The following day was spent cleaning up from the fire.[3]

Current Use: Building 4019 has been declared free from contamination, but has yet to be demolished as of 2010.[4]

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[1] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 10, 24.
[2] Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853466-HDMSP001853468.
[3] Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853466-HDMSP001853468.
[4] The Boeing Company, Santa Susana Field Laboratory, *Site Environmental Report for Calendar Year 2008 DOE Operations at The Boeing Company Santa Susana Field Laboratory Area IV*, September 2009, p. 2-4.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): A chronology of radiological investigations at this building is as follows:

- **1970 SNAP Component Removal**. Upon termination of the SNAP program in 1970, the SNAP components were removed from the building and disposed. A radiation survey was performed to ensure no residual radioactivity existed.[1]

- **1988 Rocketdyne Radiological Survey**. In 1988, Rocketdyne performed a radiological survey of Building 4019 along with Building 4013 and two adjacent areas to determine if any radioactive material remained that required further surveying or decontamination. A walk-through survey for gamma exposure rates was performed and measurements were made at 46 initial locations inside Building 4019. Analysis of initial data showed one outlier obtained in the northwest corner of the high bay. An additional 21 exposure rate measurements and beta surface activity measurements were performed to verify that the outlier was an anomaly. The average gamma exposure rate of the initial 46 locations was 7.6 microroentgens per hour (µR/hr). The average for the total 67 measurements was 7.8 µR/hr. The average exposure rate calculated for indoor samples was reported as considerably lower than the outdoor "natural background" levels ranging between 14 and 16 µR/hr. An average ambient gamma exposure rate corrected for background was 0.04 ± 1.09 µR/hr, which is less than the 5 µR/hr acceptable limit. The Building 4019 vault was handled as a separate data set because of its dissimilar construction and resultant effect on exposure rates. Ten gamma exposure rate measurements were taken in the vault with an average of 12.4 µR/hr. According to the survey report, this elevated rate was attributed to primordial isotopes in the building material and no further investigation was required. The survey concluded that none of the areas were contaminated with residual radioactivity. Acceptable limits adopted by Rocketdyne for this survey were based on enriched uranium used for SNAP programs. The maximum acceptable contamination limit for total surface area averaged over 1 square meter (m^2) was 5,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2) for alpha and beta contamination. The maximum allowable contamination for a single area not more than 100 cm^2 in that 1 m^2 was 15,000 dpm/100 cm^2 for alpha and beta contamination. The removable surface contamination limit was based on a surface wipe over 100 cm^2 and was 1,000 dpm/100 cm^2 for alpha and beta contamination. Ambient gamma exposure limits were based on the NRC limit of 5 µR/hr above background.[2]

- **1995 ORISE Verification Survey**. In 1995, the Oak Ridge Institute for Science and Education (ORISE) performed verification survey activities to validate cleanup procedures and survey methods used by Rocketdyne. The verification survey found residual beta-gamma surface contamination in excess of U.S. Department of Energy (DOE) guidelines in a 1-square-meter area of the high bay. The average beta-gamma total surface activity was 5,900 dpm/100cm^2, exceeding the DOE limit of 5,000 dpm/100cm^2. This result combined with other deficiencies, including lack of access to

[1] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 2, 24, 29.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 2, 10, 17, 20, 24, 28-29, 64-65.

the Building 4019 vault and inadequate documentation of previous surveys, led ORISE to recommend additional decontamination and surveys.[1]

- **1998 Boeing Final Status Survey**. In September 1998, Boeing conducted comprehensive decontamination and decommissioning efforts and a final status survey of Building 4019. Direct, qualitative alpha and beta-gamma scans followed by selected cumulative counts and smear surveys were conducted in the high bay, reactor test chamber, vault room, equipment room, and office areas to confirm that no contamination existed above regulatory limits. The highest quantitative total alpha measurement found was 13 dpm/100 cm^2 and the highest quantitative total beta measurement was 961 dpm/100 cm^2. These measurements are below the 5,000 dpm/100 cm^2 limit for fixed contamination. The highest removable alpha contamination found was 6 dpm/100 cm^2 and the highest removal beta found was 12 dpm/100 cm^2. These measurements are below the 1,000 dpm/100 cm^2 removable contamination limit. The high bay floor area identified above radiological limits in the 1995 ORISE survey was scabbled and samples were taken. The highest cesium-137 (Cs-137) was 1.8 pCi/g. This area was remediated and the debris was disposed of as radioactive waste. No cobalt-60 (Co-60) was detected. This survey confirmed that the facility met DOE and State of California guidelines for unrestricted use in 1998.[2]

- **1998 ORISE Re-Verification Survey**. In September 1998, ORISE performed a re-verification of Building 4019 that included surveys of both the test vault and the previously identified contaminated area in the high bay. All surface activity levels satisfied DOE and U.S. Nuclear Regulatory Commission (NRC) guidelines in 1998 (see the table below).[3]

**Surface Contamination Guidelines from
DOE Order 5400.5 (1990) and NRC Regulatory Guide 1.86 (1974)**

Allowable Total Residual Surface Contamination (dpm/100 cm^2)			
Radionuclides	**Average**	**Maximum**	**Removable**
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, and I-129	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, and I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000β-γ	15,000β-γ	1,000β-γ

[1] Vitkus, T.J. and Bright, T.L., *Verification Survey of Buildings T019 and T024 Santa Susana Field Laboratory, Rockwell International, Ventura County, California*, Oak Ridge Institute for Science and Education, February 1996, pgs. 4, 8-9, 12, 14.
[2] Liddy, P., *Building 4019 Final Status Survey Report*, The Boeing Company, June 10, 1999, p. 4.
[3] Vitkus, T., *Addendum to the Verification Survey Report for Building T019 and T024, Santa Susana Field Laboratory, Ventura County, California (ORISE 1996a),* Oak Ridge Institute for Science and Education, February 16, 1999, pgs. 2-3.

External Gamma Radiation			
The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restriction on its use shall not exceed the background level by more than 20 μR/h.			

Source: U.S. Atomic Energy Commission (now NRC) Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, June 1974, p. 1.86-5.
U.S. Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment, February 8, 1990, p. IV-6.

- **1998 California DHS Verification Survey**. In October 1998, the California Department of Health Services (DHS) performed a verification survey.[1]

- **2001 EPA Verification Survey**. In October 2001, an independent oversight verification and confirmation survey funded by the Environmental Protection Agency was conducted to compare results against previous surveys by Rocketdyne/Boeing and ORISE. The 2001 survey showed results below NRC radiological limits in 2001 (see table above) and confirmed the conclusions reached by both Rocketdyne/Boeing and ORISE.[2]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4019 was first identified on a 1965 aerial photograph. A 1967 aerial photograph identifies probable leakage emanating from the northwest corner of Building 4013 and draining southwest between Buildings 4013 and 4019 to 20th Street. A 1972 aerial photograph notes an open storage (OS) area north of Building 4019. In 1978, the open storage is identified as OS-10 and contains a probable stain and two vertical tanks. The stain and vertical tanks are noted with varying degrees of certainty in 1980, 1988, and 1995. By 2005, Building 4019 is the only structure still standing in the immediate vicinity. A probable stain, first identified in 2002, is located near the northwest corner of Building 4019.[3]

Radionuclides of Concern: Totally encapsulated highly enriched uranium was handled in Building 4019. Radionuclides resulting from reactor operations in Building 4019 include: americium-241 (Am-241), Cs-137, plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[4] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory.* Table 3.3 presents a summary of radiological contaminants of concern.

[1] The Boeing Company, Rocketdyne Environmental Affairs, *Building 4019 – SNAP Flight System Critical Facility*, January 8, 2003, pgs. 1-2.
[2] Rash, M., *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-011, T-019, T-055, and T-100*, Tetra Tech EM, Inc., December 20, 2002, pgs. 1, 26.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.

Drainage Pathways: Storm drainage for Building 4019 follows a culvert south of the building to 20th Street.[1] Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[2] The general slope of Area IV, including Building 4019, is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling. The north end of Building 4019 is near the surface drainage divide for the area. North of drainage divide, water drains northerly to Simi Valley.[3,4]

Radiological Contamination Potential: Class 1 because of former use of Building 4019.
Recommended Locations for Sediment/Soil Sampling:

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

Extensive soil sampling is recommended in the Building 4019 area. As discussed above, 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 Administrative Order on Consent. 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.

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[1] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[4] Map located at: http://dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- 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.

2.1.5 Building 4025 Area

Site Description: The Building 4025 area comprises Building 4025, Electrical Substations 4725 and 4924, Mechanical Equipment Slab 4925, Sodium Reactor Experiment Mock-Up Equipment Building 4926, and the land surrounding these buildings.[1] Building 4025 was constructed in 1959 as the Remote Handling Mock-Up Building to support Systems for Nuclear Auxiliary Power (SNAP) reactor tests. It was designated a non-nuclear facility.[2,3] Figures 2.1.5a through 2.1.5b provide a current photograph and the best available building-specific drawing(s) that the research team could find. Building 4025 was located on B Street north of Sodium Laboratory Building 4006 and west of SNAP Environmental Test Facility Building 4024. Building 4006 is discussed elsewhere in this section. Building 4024 is discussed in the Subarea HSA-5A TM. No as-built drawings were located for Building 4025. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4025 measured 5,595 square feet and consisted of a low bay, middle bay, and high bay. The building was constructed with a steel frame, roof, and siding. Ceiling heights were 9 feet, 20 feet, and 35.5 feet, respectively. Two 2-ton bridge cranes were located at the building, as was a restroom.[4,5,6] Figure 2.1.5b provides a floor plan for Building

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Chapman, J. A., *Radiological Survey of Buildings T049, T042, T027, T032, and T025, GEN-ZR-0013*, Rockwell International, Rocketdyne Division, August 8, 1988, pgs. 9, 17, 22, 24, 26, 31, 35, 109-114, 119-120.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. J-13.
[4] Chapman, J. A., *Radiological Survey of Buildings T049, T042, T027, T032, and T025, GEN-ZR-0013*, Rockwell International, Rocketdyne Division, August 8, 1988, p. 22.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. J-13.
[6] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-31.

4025. This floor plan depicts a pit at the southern end of the middle bay.[1] No other information has been located on this pit. A 1999 letter regarding demolition notes that Building 4025 will be removed and includes the following two tasks: "Excavate pits that are backfilled at B4025" and "Backfill and compact to 90% pits at B4025."[2] Another 1999 demolition letter notes that Building 4025 has a standard foundation with two 10-foot by 10-foot pits.[3] Further details on these pits are not known at this time. A demolition checklist contains hand written notes indicating Building 4025 may have had an underground storage tank (UST). Geophysical surveys did not identify a tank so it was either never present or was removed. The notes suggest drawings depict this UST.[4] No such drawings have been located to date.

A sanitary sewer line is identified north of Building 4025 with flow in the sewer line directed to the west.[5]

Former Use(s): Building 4025 was used as the Remote Handling Mock-Up Building through 1970 for remote handling and viewing of mock-up work in support of SNAP 2/10A tests, SNAP 8 tests, and other nuclear reactor tests. Following cancellation of the SNAP program in 1970, Building 4025 was designated the Energy Technology Engineering Center Instrumentation and Inventory Building and was used for component assembly, storage, and instrumentation work at least through mid-1988. An outside area surrounding Building 4025 was used as a storage yard for salvageable materials and scrap components in 1988.[6]

Information from Interviewees: None to date.

Radiological Incident Reports: There has been one incident associated with Building 4025. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4025 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0306	11/16/1979	SHIELDED AREA	Co-60	OFF SCALE DOSIMETER DURING GAMMAGRAPH OPERATION.

[1] Chapman, J. A., *Radiological Survey of Buildings T049, T042, T027, T032, and T025, GEN-ZR-0013*, Rockwell International, Rocketdyne Division, August 8, 1988, p. 24.
[2] Correspondence from McLain, S., G.D. Heil, Inc., to Mitchell, M., The Boeing Company, *Reference: ITB No. 503818, Demolition of 8 Buildings, Rocketdyne SSFL*, June 8, 1999.
[3] Correspondence from Ramirez, P.B., Boeing, Rocketdyne Propulsion & Power, to Laughlin, R., Ventura County Resource Management Agency Planning Division, *Reference: ETEC Demolition Projects, ETEC Site, Area IV, Santa Susana Field Laboratory*, June 23, 1999.
[4] Lenox, A., *SHEA Building Demolition Assessment Checklist (Refer to Demo Team Scope of Work),* The Boeing Company, April 3, 2000.
[5] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-23.
[6] Chapman, J. A., *Radiological Survey of Buildings T049, T042, T027, T032, and T025, GEN-ZR-0013*, Rockwell International, Rocketdyne Division, August 8, 1988, p. 31.

Current Use: Demolished in September 1999.[1] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): In 1988, Rockwell/Rocketdyne performed a radiological survey of Building 4025 and the surrounding parking lot/storage area outside the building. During this survey, background radiation levels were found to vary considerably and had to be statistically corrected. The most important factor influencing ambient background radiation conditions around Building 4025 was its close proximity to the Radioactive Material Handling Facility (RMHF), which stored high levels of radioactive material. The exterior storage yard was approximately 200 feet from RMHF Building 4075. After correcting for background radiation, the survey concluded that no residual radioactivity was found above Nuclear Regulatory Commission acceptance limits of 5 microroentgens per hour in 1988.[2]

Radiological Use Authorizations: None found.
Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4025 is first identified in a 1959 aerial photograph. In 1967, a possible pipeline is noted at the south side of the building. A drainage pathway and open storage (OS) area, denoted OS-2, is identified north of the building. OS-2 contained a stain in 1967. The drainage pathway and OS-2 were still visible in 1972, but not in 1978. In 1980, OS-2 was visible with a possible stain. In 2005, a ground scar is noted where Building 4025 used to exist.[3]

Radionuclides of Concern: Building 4025 was not known to have handled or stored radioactive materials. Residual radioactivity was not suspected in Building 4025 during a 1988 radiological survey.[4] However, a radiological incident report described below indicates a Co-60 source. This suggests other sealed source use in the building. Radionuclides associated with potential migration from RMHF Contaminated Equipment Storage Building 4075 include: isotopes of uranium, thorium, and plutonium; and mixed fission products.[5] Radionuclides associated with nearby SNAP Building 4024 include: americium-241 (Am-241), cesium-137 (Cs-137), Co-60, europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titantium (H-3), and natural and enriched uranium (U-234, U-235, U-238).[6] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of the radiological contaminants of concern.

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, pgs. J-13–J-14.
[2] Chapman, J. A., Radiological Survey of Buildings T049, T042, T027, T032, and T025, GEN-ZR-0013, Rockwell International, Rocketdyne Division, August 8, 1988.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Chapman, J. A., Radiological Survey of Buildings T049, T042, T027, T032, and T025, GEN-ZR-0013, Rockwell International, Rocketdyne Division, August 8, 1988, p. 31.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. I-17.
[6] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.

Drainage Pathways: Storm drainage for Building 4025 follows a culvert south of the building to 17th Street.[1] Aerial photographs from 1957 to 2005 indicate that drainage followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[2] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[3] Building 4025 was located south of RMHF Building 4075 and may have received drainage from Building 4075.

Radiological Contamination Potential: Class 1 because of proximity to SNAP Building 4024, RMHF Building 4075, and OS-2 and the potential of radioactive material migration via surface water flow or airborne release from these buildings.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the potential radioactive material migration via surface water flow or airborne release from SNAP Building 4024 and RMHF Building 4075, there is a possibility that residual contamination in the Building 4025 area will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4025 area. This includes the following Building 4025 areas:

- Pit area located at the southern end of the middle bay in the Building 4025 footprint. Lack of excavation and backfill information requires this area be examined for residual contamination.

- Pits discussed in demolition correspondence if locations can be determined. Lack of excavation and backfill information requires this area be examined for residual contamination.

- Possible UST, if location can be determined. A UST of unknown content may be a source of residual contamination.

- Area south of the Building 4025 footprint where a possible pipeline is noted in aerial photographs. If radioactive materials were released into the pipeline, residual contamination may exist in the materials surrounding the pipeline.

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[1] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Chapman, J. A., Radiological Survey of Buildings T049, T042, T027, T032, and T025, GEN-ZR-0013, Rockwell International, Rocketdyne Division, August 8, 1988, p. 17.

- Sanitary sewer line north of the Building 4025 footprint. 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 4025 footprint. Storm water originating from Building 4075 or OS-2 could discharge into this storm drain. Consequently, this storm drain may provide a pathway for the migration of radionuclides from these areas and residual contamination may be in the area.

- Drainage pathway and OS-2 north of the Building 4025 footprint where an unknown stain was identified in aerial photographs. If radioactive materials were released from OS-2, this drainage may provide a pathway for the migration of radionuclides from these areas and residual contamination may be in the area.

- Drainage pathways associated with the Building 4025 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.1.6 Building 4228 Area

Site Description: The Building 4228 area comprises the Building 4228 complex and surrounding land near the northwest property line of Area IV. The Building 4228 complex includes Building 4228, Electrical Substation 4708, Electrical Equipment Pads 4807 and 4808, Air Blast Heat Exchanger Pad 4809, and Sodium Component Test Installation (SCTI) Power Pak Cooling Tower 4710. Building 4228 was constructed in the early 1980s as the SCTI Power Pak Facility. The northwest end of Building 4228 was built on top of the Systems for Nuclear Auxiliary Power (SNAP) Critical Test Facility Building 4012.[1,2] Figure 2.1.6a provides a current photograph. The research team was unable to find building-specific drawing(s). Building 4228 was located east of SNAP Non-Nuclear Component Assembly Building 4013 and west of former SNAP 8 Experimental Reactor Building 4010. Buildings 4010, 4012, and 4013 (including Buildings 4413 and 4823) are discussed elsewhere in this section. No as-built drawings were located for Building 4228. Plate 1 presents a summary of all identified features for this site.

Building Features: A sanitary sewer map shows a sewer line that appears to be located south of the Building 4228 footprint. Building 4228 was associated with 10 aboveground tanks ranging in size from 55 gallons to 20,000 gallons. Contents included oil, morpholine, sulphuric acid, deionized water, polyphosphate, and hydrazine. Secondary containment for the 55-gallon hydrazine tank was an open concrete pit.[3] It is not known exactly where this pit was located.

Former Use(s): Building 4228 has been identified as the Power Pak facility and the SCTI Co-Generation Plant. This technical memorandum will refer to Building 4228 as the SCTI Power

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-21.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-23, b-42, b-46.

Pak facility. The SCTI Power Pak facility was designed to harness the steam produced through SCTI's sodium experiments and generate commercial electric power. The system operated from 1988 through 1993. The power generated was sold onto the grid through Edison Power.[1,2]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 2003.[3] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4228 were not conducted. Building 4012 was released by the U.S. Department of Energy by the time Building 4228 was demolished. According to a Safety, Health, and Environmental Affairs Impact Review Checklist, the demolition of Building 4228 did not involve radioactive materials and was not conducted in a radiological area.[4]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Locations: None found.

Aerial Photographs: In 1978, prior to the construction of Building 4228, an open storage (OS) area, identified as OS-7, and a possible waste disposal area (WDA), identified as WDA-6, are visible north of the Building 4228 site. A probable stain was located at the west end of OS-7. Possible solid waste debris is noted in WDA-6. Building 4228 first appears on a 1988 aerial photograph. A structure containing cooling fans (Building 4710) is visible to the east of Building 4228. An overhead pipe is also noted near the southwest corner of Building 4228. In 1995, overhead pipes, a vertical tank, and a probable stain are identified around Building 4228 and the cooling fan structure. A stain near the south end of the cooling fan structure is also noted. By 2005, all the structures associated with Building 4228 were gone.[5]

Radionuclides of Concern: The research team did not find evidence that radioactive material were used in Building 4228. Radionuclides resulting from former reactor operations in Building 4012, which supported the northwest end of Building 4228, include: americium (Am-241), cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[6,1] All radionuclides of concern

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-21.
[2] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 1, 2003, pgs. 8-9.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, pgs. L-21–L-22.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. L-21.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.

listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[2] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling. The north end of Building 4228 is near the surface drainage divide for the area. North of drainage divide, water drains northerly to Simi Valley.[3,4] Building 4228 was located on top of and south of former SNAP Critical Test Facility Building, which handled radioactive materials and generated radionuclides, and may have received drainage from Building 4012.

Radiological Contamination Potential: Class 1 because Building 4228 was located on top of and south of former SNAP Critical Test Facility Building 4012, which is also identified as Class 1.

Recommended Locations for Sediment/Soil Sampling:

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

Extensive soil sampling is recommended in the Building 4228 area primarily because it was constructed on top of former SNAP Critical Test Facility Building 4012. Significant information is lacking regarding the excavation activities at Building 4228. Radiological surveys specific to Building 4228 were not conducted and previous characterization studies for the Building 4012 area were focused on delineating the extent of contamination to standards that were applicable at the time. Previous characterization studies for the Building 4012/4228 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 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4228 area. This includes the following Building 4228 areas and appurtenances:

- Former Building 4012 critical cell (Room 110) and fuel storage room (Room 109) in the northern Building 4228 footprint. Past contamination of these rooms may have left residual contamination in the area.

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1 Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
2 Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
3 Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
4 Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Former Building 4012 radioactive waste tank holdup tank outside Room 104 on the south side of the Building 4228 footprint. The known radioactive waste holdup tank may have left residual contamination in the area.

- Sanitary sewer line located south of the Building 4228 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 and possible WDA-6 identified on aerial photographs north of the Building 4228 footprint. If radioactive materials were stored or disposed in OS-7 or WDA-6, contamination could have migrated to the Building 4228 area, and residual contamination may exist.

- Probable stain identified on a 1995 aerial photograph east of the Building 4228 footprint and at south end of Building 4710 footprint. The unknown stains may be possible sources of contamination.

- Drainage pathways associated with the Building 4228 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.1.7 Building 4310 Area

Site Description: The Building 4310 area comprises Building 4310 and the land surrounding it. Building 4310 was constructed in the early 1960s. It was a small, portable structure. Building 4310 appears near Systems for Nuclear Auxiliary Power (SNAP) Experimental Reactor Building 4010 on a January 1967 industrial planning map. It appears near Small Component Test Loop (SCTL) Building 4826, and Control Element Test Structure 4354 on industrial planning maps from 1971 through 1973.[1,2] Because Building 4310 changed locations, it is discussed as part of Group 1 and Group 6 building areas. Figure 2.1.7a provides a current photograph. The research team was unable to find building-specific drawing(s). Buildings 4010, 4354, and 4826 are discussed elsewhere in this section. No as-built drawings were located for Building 4310. Plate 1 presents a summary of all identified features for this site.

Building Features: A sanitary sewer map shows a sewer line that appears to be located south of the original Building 4310.[3]

Former Use(s): Building 4310 was identified as a portable change room on industrial planning maps.[4] Presumably a portable change room is a non-permanent structure used for changing clothes.

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-9.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-23.
[4] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Building 4310 was relocated near the SCTL Buildings 4826 and 4354 sometime between 1967 and 1971.[1,2] The research team could not find any detailed information describing how the building was moved.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4310 were not conducted. The original Building 4310 location was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4310. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[3]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4310 is first identified on a 1967 aerial photograph near Building 4010. The 1967 aerial photograph indicates that drainage flows southwest from an open storage (OS) area identified as OS-2 in Subarea HSA-7 toward Building 4010 and 4310. By 1972, Building 4310 was relocated and included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis.[4]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4310. Radionuclides associated with potential migration from SNAP Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium isotopes

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-9.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

(U-234, U-235, U-238).[1,2,3] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[4] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage reportedly occurs only after controlled effluent holdup and sampling.[5,6]

Radiological Contamination Potential: Class 1 for original Building 4310 site because of proximity to SNAP Buildings 4010 and 4012 and the potential of radioactive material migration via surface water flow or airborne release from these buildings.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4310 area primarily because of its proximity to SNAP Buildings 4010 and 4012 and the potential for radioactive material migration via surface water flow or airborne release from these areas. Radiological surveys specific to Building 4310 were not conducted and previous characterization studies for the Building 4310 area were focused on delineating the extent of contamination to standards that were applicable at the time. Previous characterization studies for the Building 4310 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 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4310 area. This includes the following Building 4310 areas and appurtenances:

- Sanitary sewer located south of the Building 4310 footprint. If radioactive materials were released into sewer lines, residual contamination may exist in materials inside and surrounding the sewer lines.

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[2] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790,* Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[3] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Drainage pathways associated with the Building 4310 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2 Group 2

The Group 2 index map is presented in Figure 2.2. Following Figure 2.2, the site photograph and layout drawings for each building area within HSA-5B Group 2 are presented. HSA-5B Group 2 includes 11 building areas that were part of the Sodium Component Test Installation (SCTI) Building Complex. Note that Building 4358, originally built to support SCTI, was later moved to support the Small Component Test Loop (SCTL). As a result, Building 4358 will be discussed as appropriate in Group 2 and Group 4 of this section.

2.2.1 Building 4355 Area

Site Description: The Building 4355 area comprises Building 4355, Electrical Substation 4756, and the land surrounding these buildings near B Street. Building 4355 was the Control Center for the SCTI Building Complex constructed between 1959 and 1964. The SCTI Building Complex included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756. These buildings are discussed later in this section. Building 4355 was located adjacent to SCTI Buildings 4356, 4357, and 4359, and north of SCTL Buildings 4026, 4226, and 4826.[1,2,3] Figures 2.2.1a through 2.2.1b provide a current photograph and the best available building-specific drawing(s) that the research team could find. No as-built drawings were located for Building 4355. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4355 was a 4,369-square-foot steel-framed enclosed structure.[4,5] Building 4355 contained restrooms and air conditioning. The ceiling height was 10 feet.[6] Figure 2.2.1b presents a floor plan for Building 4355 with notations depicting the control room, lab, computer, lockers, transformer, hot water, and rest rooms. A sanitary sewer map shows that at one point a sewer line branch connected to the north side of Building 4355. The branch line runs north and connects to a sewer main south of Building 4013.[7] A 1966 drawing depicts a below-grade pipe running from a floor drain on the east side of Building 4359 to a catch basin located

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[1] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 7, 13-14.

[2] DE-AC03-98SF21530, *Environmental Restoration and Remediation of the Former Energy Technology Engineering Center*, Contract Awarded to Boeing North American, Inc., Rocketdyne Propulsion & Power, December 31, 1998, Attachment 1, Appendix 2, pgs. 1-2.

[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. P-19.

[4] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, p. 14.

[5] DE-AC03-98SF21530, *Environmental Restoration and Remediation of the Former Energy Technology Engineering Center*, Contract Awarded to Boeing North American, Inc., Rocketdyne Propulsion & Power, December 31, 1998, Attachment 1, Appendix 2, pgs. 1-2.

[6] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-36.

[7] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-23.

between Buildings 4026 and 4355.[1] A riser located on the south side of Building 4355 supplied water for the sprinkler system in Buildings 4355 and 4357.[2]

Former Use(s): Building 4355 was the SCTI Control Center and contained the control room, data acquisition system, offices for facility management and staff, restrooms, a small chemistry laboratory, a facility record storage.[3] Building 4355 was used to monitor and control operations in Building 4356.[4]

Information from Interviewees: A number of former employees were interviewed about their experience at the SSFL. Two remembered Building 4355. Excerpts from these interviews are included below.

Interviewee 195 started working in Area IV on the hill in 1968 at the Building 355 SCTI and later went into other buildings like Building 19, Building 4013, Building 59, and the infamous sodium burn pit. The following excerpts were pulled from the interview.

> *"I tried to keep to procedures and I made an entry in the logbook when I was performing something. I was the shift leader at SCTI and when you took on that responsibility for a shift, say from 8 to 3:30, you wrote in the logbook who was doing what: "Joe Blow is doing Procedure X, Revision whatever." My boss would review my logbook— everything was supposed to be logged. Some facilities were tighter and some were looser about logbooks.*
>
> *At SCTI we were not required to wear film badges but there were certain areas in Area IV where you were required to wear a film badge. Some of the sodium tanks had radioactive material to measure the level of the materials in the tanks. In Buildings 13 and 19 we didn't need to wear them."*[5]

Interviewee 63 worked at the Santa Susana Field Laboratory for 42 years starting in June 1957 at the Sodium Reactor Experiment, then leaving SSFL for a few years and returning back to the hill in 1965 or 1966. The following excerpts were pulled from the interview.

> *I finally got back up on the hill in about 1965 or 1966 and I stayed up there until I retired. When I first got back up on the mountain, I did engineering studies – paper studies looking at various reactor designs. Later I was assigned to be the manager of the SCTI in about 1968 or 1969. There we tested steam generating equipment. I did that for a number of years. In mid-1970, I was made manager of operations. I had 120 employees and all of the work was non-nuclear. There were many operating facilities at SSFL during that time. We had a big pump test*

[1] *SSFL Area IV, Bldg. 359, Water/Sewer Distribution, Demolition & Installation, M359-68339-MI*, Rockwell International, December 12, 1966, HDMSe00455082.
[2] Gump, J.A., *Building Construction and Protection Survey, Building/Facility 357/SSFL*, April 23, 1987.
[3] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 13-14.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. P-19.
[5] Interview No. 195 conducted by DOE in 2010.

loop and a number of instrumentation areas. We had an instrument lab and a chem lab.

I didn't need to wear a film badge at SCTI or thereafter. The only time I had to wear a film badge was when I worked at the Sodium Reactor Experiment

The SCTI cooling tower put off a plume of steam. I heard that people were worried about that plume. All it had in it was steam, water! People assumed it was like the towers that they frequently used to depict the accident at Three Mile Island, even though those were equally innocuous.

The primary purpose of the SCTI was to come up with a foolproof design. We wanted to make something that would be safe, right off the shelf. It couldn't have leaks or other problems. It needed to be leak-proof and dependable. The Big Pump Test Facility was used for a number of purposes. All the work we did there was developmental. We were always trying to improve on the design, make better probes, better pumps, improve reliability."[1]

Radiological Incident Reports: There has been one incident associated with Building 4355. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4355 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0184	4/15/1988	OUTSIDE BARRIER	Ir-192	BOTTLED WATER DELIVERY MAN PASSED THROUGH R/A BARRIER OF RADIOGRAPHER.

Current Use: Demolished in 2003.[2] SCTI demolition involved removal of building structures, followed by grade-level concrete slabs, ramps, footings, and pavement, and finally below-grade pipes, ducts, trenches, tanks and pits. It doesn't appear that there were any large pits associated with Building 4355. The exact dimensions of the excavation are unknown. Backfilling and grading operations used on-site soil, possibly from the Area IV borrow area.[3,4]

[1] Interview No. 63 conducted by DOE in 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-19.
[3] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.
[4] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): During demolition in 2003, Building 4355 debris was surveyed daily for total and removable contamination. No radiological contamination reportedly was detected.[1]

Radiological Use Authorizations: Use Authorization 117D, dated July 1, 1984, permitted the operation of Bowed Tubes Measurement. The authorization specified the use of a 1.0 microcurie cobalt-60 (Co-60) sealed source that was checked annually to ensure that no leakage occurred.[2] A 1995 radioactive materials inventory also noted use of cesium-137 (Cs-137) sealed sources in Building 4355.[3,4]

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4355 is first identified in a 1959 aerial photograph with an area of probable leakage located near the southwest corner of the building. Building 4355 is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. A 1965 aerial photograph shows an expansion of Building 4355 to the west. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. A possible stain was noted in 1980 and 1983 and a probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4357 is no longer present in PA-1.[5]

Aerial photograph analysis from 1959 to 2005 identifies a hazardous material storage area (HMSA) located east of Building 4355 inside PA-1. In 1959, a new building (possibly Building 4357), a possible below ground/recessed area, and a possible stain were observed. The possible recessed area remained visible in 1962/63 and a possible underground storage tank was noted. These features could not be confirmed on the 1965 or 1967 photographs. By 1978, a probable open storage area was observed housing approximately six to eight objects, each about one-fourth the size of an automobile. In 1980, probable staining was observed, and in 1983 and 1987 an area of dark-toned material was visible. In 1990 and 1992, areas of possible staining were noted. By 1993, this area no longer appeared active. In 1998, approximately 12 containers, each about the size of an automobile, were observed at this location. By 2002, the containers and the building had been removed from the former HMSA.[6]

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-19.
[2] Review of Radiation Safety Records Management System, 2010.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-19.
[4] Review of Radiation Safety Records Management System, 2010.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

Radionuclides of Concern: Sealed source use of Co-60, Cs-137, and Ir-192 are described above in Radiological Use Authorizations and Radiological Incident Reports. Other sealed source use is possible. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, Co-60, europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium (H-3), and natural and enriched uranium isotopes (U-234, U-235, U-238).[1,2,3] All radionuclides of concern listed, with the exception of Ir-192, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 has half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A 1966 drawing depicts a below-grade storm drain running northeast across the Building 4355 footprint to a catch basin located between Buildings 4026 and 4355.[4] A hazardous material spill report states that a local underground drainage system was approximately 30 feet away from a spill site at Building 4355.[5] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[6] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[7,8] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4355. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4355.

Radiological Contamination Potential: Class 1 because sealed radioactive material sources were used in Building 4355 and there is a potential of radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012.

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[2] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors*, *AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[3] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[4] *SSFL Area IV, Bldg. 359, Water/Sewer Distribution, Demolition & Installation, M359-68339-MI*, Rockwell International, December 12, 1966, HDMSe00455082.
[5] Internal correspondence from Christy, Lt. T.L. to Greenwell, Capt., W.I., Rockwell International, *Reference: Hazardous Material Spill, Sulfuric Acid, Bldg. 355 Area of SCTI, Santa Susana Facility*, September 27, 1988.
[6] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[7] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[8] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Recommended Locations for Sediment/Soil Sampling:

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

Due to radioactive sealed source use and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4355 area. This includes the following Building 4355 areas:

- Sanitary sewer located at the north side of the Building 4355 footprint. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Former below-grade storm drain located under southeastern portion of the Building 4355 footprint. Storm water originating from Buildings 4010 or 4012 could potentially discharge into this storm drain. Consequently, this storm drain may provide a pathway for migration of radionuclides from these areas and residual contamination may exist in the area.

- Former catch basin area located between the Building 4026 footprint and the Building 4355 footprint. Storm water originating from Buildings 4010 or 4012 could potentially discharge into this catch basin. Consequently, the catch basin may be an area with residual contamination.

- Area of probable leakage identified in aerial photograph at southwest corner of the Building 4355 footprint. If radioactive materials were released, residual contamination may exist.

- Former underground drainage system near the Building 4355 footprint, if location can be determined. If radiological materials were released into the drainage system, residual contamination may exist in the area.

- Drainage pathways associated with the Building 4355 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.2 Building 4356 Area

Site Description: The Building 4356 area comprises Building 4356, Building 4656 Cooling Stacks, and the land surrounding these buildings. Building 4356 was constructed in 1959 as the Sodium Component Test Installation (SCTI) High Bay. The SCTI Building Complex included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756. Most of the facility process systems were contained within or adjacent to Building 4356. The Building 4656 Cooling Stacks were southwest of Building 4356.[1,1,2] Figures 2.2.2a through 2.2.2c provide a

[1] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 7-8, 13-14.

current photograph and the best available building-specific drawing(s) that the research team could find. Building 4356 was located south of B Street, between 17th and 20th Streets, adjacent to SCTI Building 4355.[3] The remaining SCTI Buildings listed above are discussed elsewhere in this section. No as-built drawings were located for Building 4356. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4356 was a 9,560-square-foot steel-framed enclosed structure that housed the steam generator test articles, sodium system, and two fossil fuel-fired sodium heaters.[4] Building 4356 did not contain any restrooms or heating and ventilation features. The ceiling height was 65 feet.[5] The SCTI Complex included a sodium heater, a primary sodium heat transfer system, a secondary sodium heat transfer system, a steam and feed water system, a circulating cooling water system, and supporting equipment and systems. Four sodium drain tanks and a reaction tank were located in below-grade concrete pits that extended up to 54 feet below grade. An additional 22 aboveground tanks containing sodium, sulfuric acid, calcium hydroxide, sodium hydroxide, morpholine, brine, gaseous argon, hydrazine, deionized water, and diesel oil, were associated with Building 4356.[6,7] Figure 2.2.2b presents a floor plan of Building 4356 and denotes a large pit in the center of the facility. Figure 2.2.2c presents an area plan for the west yard of Building 4356 that denotes a secondary containment pit, trench, and some of the tanks associated with the SCTI.

Former Use(s): The SCTI Complex was a development test facility for liquid metal (sodium) system components. It provided a test site for the non-nuclear developmental testing of typical liquid metal reactor components, primarily steam generators. The SCTI Complex was originally designed to test sodium-heated steam generators and sodium-to-sodium intermediate heat exchangers under simulated sodium-cooled nuclear power plant operating conditions at a power level of 35 megawatts thermal. It operated from 1964 through 1995 and underwent system upgrades to the steam and feed water systems in 1973. Further modifications in the late 1970s and early 1980s included the addition of a second sodium heater and the replacement of most of the steam/feed water system and the water make-up system.[8] Operations included sodium tank cleaning, generation of steam from a sodium heat source, water treatment, and x-ray operations.[9]

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[1] DE-AC03-98SF21530, *Environmental Restoration and Remediation of the Former Energy Technology Engineering Center*, Contract Awarded to Boeing North American, Inc., Rocketdyne Propulsion & Power, December 31, 1998, Attachment 1, Appendix 2, p. 2.

[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-21.

[3] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

[4] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, p. 13.

[5] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-36.

[6] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 7-8, 13-15.

[7] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-43, b-47.

[8] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 7-8, 13.

[9] *Group 5 –Central Portion of Areas III and IV, RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume IX – RFI Site Reports, Appendix R*, Hazardous Materials Storage Area, CH2M Hill, November 2008, p. Table R.2-1.

Information from Interviewees: A number of former employees were interviewed about their experience at the Santa Susana Field Laboratory. Four remembered specific information about Building 4356. Excerpts from these interviews are included below.

Interviewee 135 started with Atomics International in 1974 and was a project manager at the SCTI working on the steam feed system. The following excerpt was pulled from the interview.

> *"The SCTI steam and feed water system condensers produced what was really pure distilled water and we wanted to pipe it into the Simi Valley water system rather than dispose of it on site. There were people who came from all over the United States to protest this plan. It was eventually piped over to Silvernale Reservoir. The SCTI was originally a heat exchanger test facility – one of the boilers had been salvaged from a battleship."* [1]

Interviewee 255 was an atomic reactor inspector and x-ray technician at the Santa Susana Field Laboratory from 1967 to 1985. The following excerpts were pulled from the interview.

> *"I remember one time we went down to Building 4356, where the steam generator was located in SCTI, and I was going down in the pit to do some inspection. I got down to the bottom grating and the whole bottom floor, about 10 feet down, was full of water. The sump pump had quit working.*
>
> *I think the worst job I had was x-raying inside a gas-fired heater at SCTI. You had to go in and set up your equipment and your film, crawl out through a burner opening, run the iridium pill out, x-ray it, crawl back into the heater and make another set up to do it all over again."*[2]

Interviewee 279 worked at the Santa Susana Field Laboratory an instrumentation engineer in the mid-1960s to support procurement of a data acquisition system the SCTI. The following excerpts were pulled from the interview.

> *"Occasionally we would get a leak in the piping at the SCTI. If sodium leaked out, it would cause a fire. We were all trained in what to do when something like that happened. We had some powder that we would sprinkle on it, I think maybe it was calcium carbonate, that would put it out. Sometimes we would call the fire department if we couldn't get it out ourselves. When we would get a leak, we would have to shut the experiment down, drain the sodium back out of the pipes into the tanks, wait for everything to cool down, and then fix the leak. It didn't happen often, but it did happen."*[3]

Interviewee 290 worked at the Santa Susana Field Laboratory for 35 years from January 1964 to January 1999 starting as a forklift operator and later becoming a shift leader and operations engineers. The following excerpts were pulled from the interview.

[1] Interview No. 135 conducted by DOE in 2010.
[2] DOE/EPA Joint Interview 255, July 2010.
[3] Interview No. 279 conducted by DOE in 2010.

> *"I spent 11 years in Building 356, which was the SCTI….. All my work was sodium non-nuclear, with no responsibilities relating to radiological materials or waste…. Sodium leaks happened on occasion. I remember several at the SCTI, which caused a lot of damage."*[1]

Radiological Incident Reports: There have been several incidents associated with Building 4356. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4356 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0639	10/7/1974	SCTI TANK #5	Cs-137	SOURCE REMOVED FROM SCTI SURGE TANK AND STORED WITH OUT APPROVAL.
A0093	12/8/1981	TEST STAND	Ir-192	RADIOGRAPHIC SOURCE PIGTAIL UNCOUPLED AND FELL TO DECK.
A0138	5/11/1985	SCTI 3RD DECK	Ir-192	SOURCE STUCK IN SHORT RADIUS TUBE DURING RADIOGRAPHIC OPERATION AT SCTI.
A0153	2/20/1986	SCTI	Ir-192	RADIOGRAPHY BARRIER REMOVED AND EMPLOYEES ENTERED AREA.

- On December 8, 1981, an iridium-192 (Ir-192) radiographic source pigtail uncoupled and fell to the deck of the SCTI test stand (A0093).[2] A pigtail is a source assembly that consists of the sealed source and a connector that attaches the source to the control cable.[3] The research team has not located the original incident report.

- On May 11, 1985, an employee gammagraphing between the 2nd and 3rd deck of the SCTI could not retrieve the 45 curie (Ci) Ir-192 source. The source had become stuck in the short radius tube during radiographic operations. The employee was advised to stay clear of the area and security and management were notified. Survey meters and dosimeters were brought to Building 4356 and security road blocks were put in place. The dose rate at the radiographer's barrier rope on the east side indicated 12 milliroentgens per hour (12 mR/hr). The radiographer pointed out the source location below the floor on the 3rd deck along the steam generator. The dose rate was approximately 3 roentgens per hour (R/hr) at 4 feet from the back side of the source. A bend in the tube was pried back to allow the source to be cranked back into the lead camera. One employee received 2 millirems

[1] Interview No. 290 conducted by DOE in 2010.
[2] Review of Radiological Incident Index, 2010.
[3] "License for Radiography and Radiation Safety Requirements for Radiographic Operators," 10 C.F.R. §§ 34.3 and 34.43, 2010.

(mrem) during the source recovery for a total of 13 mrems for the day. The health physicist on site received 18 mrem during the recovery (A0138).[1]

Current Use: Demolition of the SCTI Complex began in 1997 and was completed in 2002.[1] Building structures were removed followed by the below-grade pipes, ducts, trenches, tanks and pits. The concrete pits extended up to 54 feet below grade and required extensive soil excavation. The exact dimensions of the excavation are unknown. Backfilling and grading used on-site soil, possibly from the Area IV borrow area.[2,3]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): During demolition in 2003, Building 4356 debris was surveyed daily for total and removable contamination. No radiological contamination reportedly was detected.[4]

Radiological Use Authorizations: Use Authorization Series 72, originally dated January 8, 1974, permitted the use of two 250 microcurie (μCi) cesium-137 (Cs-137) sealed sources and one 100 μCi Cs-137 sealed source that were used as sodium level gauges. These sources were checked annually to ensure that no leakage occurred.[5]

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4356 is first identified in a 1959 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. A possible stain was noted in 1980 and 1983 and a probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4356 is no longer present in PA-1.[6]

Radionuclides of Concern: Sealed source use of Cs-137 and Ir-192 are noted above in Radiological Use Authorizations and Radiological Incident Reports. This suggests potential use of other sealed sources as well. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-

[1] Internal Correspondence from Badger, F.H. to Radiation & Nuclear Safety Group, Rockwell International, *Re: Radiological Safety Incident Report, T-356 SCTI, May 11, 1985*, May 15, 1985.
[2] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, pgs. 39-45.
[3] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-21.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-21.
[6] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium (H-3), and natural and enriched uranium (U-234, U-235, U-238).[1,2,3] All radionuclides of concern listed, with the exception of Ir-192, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 has half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Storm drainage for Building 4356 follows a culvert west and then southwest of the building to 20th Street.[4] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[5] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4356. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4356.

Radiological Contamination Potential: Class 1 because sealed radioactive material sources were used in Building 4356, there is a potential of radioactive material migration via surface water flow or airborne release from SNAP Buildings 4012 and 4012, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the radioactive sealed source use, potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4012 and 4012, and lack of site investigation, there is a possibility that radionuclide concentrations in soil will exceed the standards required by the December 2010 Administrative Order on Consent. Therefore,

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[2] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790,* Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[3] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

additional characterization is recommended for the Building 4356 area. This includes the following Building 4356 areas:

- Former secondary containment pits (large pit and several smaller pits) and trench locations in the Building 4356 footprint and in the west yard area. If radiological materials migrated or were released into the pits or trench drainage system, residual contamination may exist in the area.

- Former sealed source storage areas within the Building 4356 footprint, if further location information can be determined. If any radioactive material was released from use of sealed sources, residual contamination may exist.

- Storm drain located at southwestern portion of the Building 4356 footprint and along southwestern portion of the west yard. Storm water drainage may provide a pathway for migration of radionuclides originating from Buildings 4010 or 4012. Consequently, this storm drain may provide a pathway for migration of radionuclides and residual contamination may exist in the area.

- Drainage pathways associated with the Building 4356 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.3 Building 4357 Area

Site Description: The Building 4357 area comprises Building 4357 and the land surrounding it near B Street and 17th Street.[1] Building 4357 was constructed in 1958 as the Heat Transfer Loop Control Building. It later became part of the Sodium Component Test Installation (SCTI) Building Complex, serving as a storage building. The SCTI Building Complex included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756.[2,3] Building 4357 was located adjacent to SCTI Building 4355 and north of Small Component Test Loop (SCTL) Building 4026, both discussed elsewhere in this section. Figures 2.2.3a through 2.2.3b provide a current photograph and the best available building-specific drawing(s) that the research team could find. . No as-built drawings were located for Building 4357. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4357 was constructed with a concrete slab floor and steel frame siding and roof. The building measured 42 feet long, 20 feet wide, and 10 feet high with 840 square feet of floor area. Building 4357 was not connected to the water or sewer system.[4] Figure 2.2.3b presents a floor plan for Building 4357. Room 100 housed electrical switch gear no longer in use and sodium pump parts. Room 101 was used for storage of sodium pump parts. A riser located on the south side of Building 4355 supplied water for the sprinkler system in

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-25.
[3] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[4] *Appendix A, Building Reconnaissance Report, Building 357, GEN-??-0000*, July 30, 1996, pgs. 31, 34.

Building 4357 through a 2-inch pipe.[1] A 2,000-gallon aboveground liquid argon tank (T-357) was associated with Building 4357.[2]

Former Use(s): Building 4357 was first used as a Heat Transfer Loop Control Building and later a Pump Bearing Test Facility Control Building for the Liquid Metal Engineering Center (LMEC) and Energy Technology Engineering Center (ETEC). By 1987, Building 4357 served as the SCTI Storage Building after serving as the Pump Bearing Test Facility Control Room. The SCTI Complex was a development test facility for liquid metal (sodium) system components. The facility provided a test site for the non-nuclear developmental testing of typical liquid metal reactor components, primarily steam generators.[3,4]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 2002.[5] SCTI demolition involved removal of building structures, followed by grade-level concrete slabs, ramps, footings, and pavement, and finally below-grade pipes, ducts, trenches, tanks and pits. The exact dimensions of the excavation are unknown. Backfilling and grading operations used on-site soil, possibly from the Area IV borrow area.[6,7]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): During demolition, Building 4357 debris was surveyed daily for total and removable contamination. No radiological contamination was reportedly detected. At demolition and prior to disposition, liquid sodium from the SCTI Complex was tested for radioactivity and reportedly found to be free of contamination.[8]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4357 is first identified in a 1959 aerial photograph. It is located in the southwest corner of a hazardous material storage area (HMSA) within a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in the HMSA, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. In 1959, a possible below

[1] Gump, J.A., *Building Construction and Protection Survey, Building/Facility 357/SSFL*, April 23, 1987.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT*-0027, Revision B, Rockwell International Corporation, August 1993, pgs. b-43, b-48.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-25.
[4] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-25.
[6] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.
[7] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.
[8] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-25.

ground/recessed area and a possible stain were observed. The possible recessed area remained visible in 1962/63 and a possible underground storage tank was noted. These features could not be confirmed on the 1965 or 1967 photographs. By 1978, a probable open storage area was observed in the HMSA containing approximately six to eight objects. In 1980, probable staining was observed, and in 1983 and 1987 an area of dark-toned material was visible. In 1990 and 1992, areas of possible staining were noted in the HMSA. By 1993, this area no longer appeared active. In 1998, approximately 12 containers were observed at this location. By 2002, the containers and the building had been removed from the HMSA.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4357.[2] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium (H-3), and natural and enriched uranium (U-234, U-235, U-238).[3,4,5] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[6] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[7,8] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4357. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4357.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] *Appendix A, Building Reconnaissance Report, Building 357, GEN-??-0000*, July 30, 1996, pgs. 31, 34.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[4] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790,* Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[5] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[6] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[7] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[8] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Radiological Contamination Potential: Class 2 because of the potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standards required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4357 area. This includes the following Building 4357 areas:

- Low-lying areas north and east of the Building 4357 footprint included in the HMSA where recessed areas were identified in aerial photographs. Low-lying areas could collect possible radioactive drainage from Buildings 4010 and 4012 and may contain residual contamination.
- Possible stained areas identified in aerial photographs north and east of the Building 4357 footprint. Unknown stains could possibly contain residual contamination.

- Drainage pathways associated with the Building 4357 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.4 Building 4358 Area

Site Description: The Building 4358 area comprises Building 4358 and the land surrounding it. Building 4358 was constructed in 1967 as the Sodium Component Test Installation (SCTI) Chemical Storage Building. It was located northwest of SCTI Building 4656 at the corner of B and 20th Streets. In 1978, the building became a Small Component Test Loop (SCTL) Chemical Storage Building and was moved to a new location south of SCTL Building 4026 and west of 17th Street.[1,2,3] Because Building 4358 changed locations, it is discussed as part of Group 2 and Group 4 building areas. Figures 2.2.4a through 2.2.4b provide a current photograph and the best available building-specific drawing(s) that the research team could find. SCTI Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, and 4656 are all discussed elsewhere in this section. No as-built drawings were located for Building 4358. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4358 was constructed with a concrete slab floor and steel frame, siding, and roof. The building measured 22 feet long, 50 feet wide, and 12 feet high with 1,120

[1] *Appendix A, Building Reconnaissance Report, Building 358, GEN-??-0000,* November 15, 1996, p. 31.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Wondolleck, John, *Area IV Santa Susana Field Laboratory, Environmental Impact Statement, Draft Gap Analysis Report*, CDM, June 1, 2008, Appendix A, p. 13.

square feet of floor area.[1] Building 4358 did not contain any restrooms, but was heated.[2] Figure 2.2.4b presents a floor plan of Building 4358.

Former Use(s): Building 4358 was originally constructed as a chemical storage facility in support of SCTI. The building was relocated and became a chemical storage building in support of SCTL and Kalina operations.[3]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Building 4358 was moved to a new location south of SCTL Building 4026 and west of 17th Street in 1978.[4,5,6] The research team could not find any detailed information describing how the building was moved or if a building foundation remained in place.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): The original Building 4358 location was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4358. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[7]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4358 is first identified in a 1967 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. In 1978, Building 4358 is relocated, but is still within PA-1. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot

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[1] *Appendix A, Building Reconnaissance Report, Building 358, GEN-??-0000*, November 15, 1996, p. 31.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-36.
[3] Wondolleck, John, *Area IV Santa Susana Field Laboratory, Environmental Impact Statement, Draft Gap Analysis Report*, CDM, June 1, 2008, Appendix A, p. 13.
[4] *Appendix A, Building Reconnaissance Report, Building 358, GEN-??-0000*, November 15, 1996, p. 31.
[5] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[6] Wondolleck, John, *Area IV Santa Susana Field Laboratory, Environmental Impact Statement, Draft Gap Analysis Report*, CDM, June 1, 2008, Appendix A, p. 13.
[7] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

be attributed to specific buildings, unless explicitly stated. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. In 1988, possible saturated material was identified along the southeast side of Building 4358. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4358 was no longer present in PA-1.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4358. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Building 4019 include: americium-241 (Am-241), cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[2,3] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of the radiological contaminants of concern.

Drainage Pathways: Storm drainage for the original 1967 Building 4358 location follows a culvert along 20th Street.[4] Aerial photographs from 1965 to 2005 show drainage flowing south from 20th Street and continuing into Area III impoundments.[5] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Building 4019 could potentially impact Building 4358 at its original location. The SNAP building handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4358.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, and limited site investigation.

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.
[3] Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853462.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.4 provide a convenient reference for the following recommendations.

Due to the limited site investigation and potential for radioactive material migration via surface water flow or airborne release from SNAP Building 4019, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the original Building 4358 area. This includes the following Building 4358 areas:

- Storm drain west of the Building 4358 footprint near the 20th Street drainage. The storm drain collects storm water from former SNAP Building 4019. Residual contamination from the storm drain may exist.

- Drainage pathways associated with the Building 4358 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.5 Building 4359 Area

Site Description: The Building 4359 area comprises Building 4359 and the land surrounding it. Building 4359 was constructed in approximately 1975. The structure built was as the Sodium Component Test Installation (SCTI) Atomizing Air Building. The SCTI Complex included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756. Building 4359 was located south of SCTI Building 4355 and west of Small Component Test Loop (SCTL) Building 4026.[1,2,3,4] Figures 2.2.5a through 2.2.5b provide a current photograph and the best available building-specific drawing(s) that the research team could find. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4359 was a 500-square-foot metal-framed building with corrugated sheet metal roofing and siding. Its size has been reported anywhere from 500 to 775 square feet.[5,6,7] Building 4359 did not contain any restrooms or heating and ventilation features.

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[1] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[2] Correspondence from Mattera, N.L., The Boeing Company, to Brown, A., Ventura County Air Pollution Control Division, *Reference: Sodium Component Test Installation (SCTI) Facility Demolition Project, Building 4392 and 4359 at the Santa Susana Field Laboratory (SSFL)*, April 6, 2000.
[3] Energy Technology Engineering Center, *Technical Site Information, Energy Technology Engineering Center (ETEC),GEN-AT-0027, Revision B*, August 1993, p. b-36.
[4] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[5] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[6] Correspondence from Mattera, N.L., The Boeing Company, to Brown, A., Ventura County Air Pollution Control Division, *Reference: Sodium Component Test Installation (SCTI) Facility Demolition Project, Building 4392 and 4359 at the Santa Susana Field Laboratory (SSFL)*, April 6, 2000.
[7] Energy Technology Engineering Center, *Technical Site Information, Energy Technology Engineering Center (ETEC),GEN-AT-0027, Revision B*, August 1993, p. b-36.

The ceiling height was 15 feet.[1] Figure 2.2.5b shows a water/sewer distribution drawing for Building 4359. This 1966 drawing depicts a below-grade pipe running from a floor drain on the northeast side of Building 4359 to a catch basin located between Buildings 4026 and 4355.[2]

Former Use(s): Building 4359 was identified as the SCTI Atomizing Air Building and housed an air compressor for the SCTI facility. The SCTI complex was a development test facility for liquid metal (sodium) system components. The facility provided a test site for the non-nuclear developmental testing of typical liquid metal reactor components, primarily steam generators.[3] Building 4359 was later converted to a parts storage building with some electrical control switches.[4]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 2002.[5] Building structures were removed followed by the below-grade pipes, ducts, trenches, tanks and pits. It doesn't appear that there were any large pits associated with Building 4359. The exact dimensions of the excavation are unknown. Backfilling and grading used on-site soil, possibly from the Area IV borrow area.[6,7]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): During demolition, Building 4359 debris was surveyed daily for total and removable contamination. No radiological contamination reportedly was detected. At demolition and prior to disposition, liquid sodium from the SCTI complex was tested for radioactivity and reportedly found to be free of contamination.[8]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: In 1959, prior to the construction of Building 4359, an area of probable leakage is identified in what would become the northwest portion of Building 4359. Building 4359 is first identified in a 1978 aerial photograph and is included in a processing area (PA)

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[1] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-36.
[2] *SSFL Area IV, Bldg. 359, Water/Sewer Distribution, Demolition & Installation, M359-68339-MI*, Rockwell International, December 12, 1966, HDMSe00455082.
[3] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[4] Correspondence from Mattera, N.L., The Boeing Company, to Brown, A., Ventura County Air Pollution Control Division, *Reference: Sodium Component Test Installation (SCTI) Facility Demolition Project, Building 4392 and 4359 at the Santa Susana Field Laboratory (SSFL)*, April 6, 2000.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-33.
[6] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.
[7] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.
[8] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-33.

designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. Aerial photographs from 1978 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4359 was no longer present in PA-1.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4359. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium (H-3), and natural and enriched uranium (U-234, U-235, U-238).[2,3,4] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[3] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[5,6] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4359. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4359.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, and lack of site investigation.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[3] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[4] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4359 area. This includes the following Building 4359 areas:

- Former floor drain and pipe location running northeast from northeast portion of the Building 4359 footprint. If radioactive materials were released into the building drain system, residual contamination may exist in materials surrounding the drain and pipe lines.

- Former catch basin area located northeast of the Building 4359 footprint. Storm water originating from Buildings 4010 or 4012 could potentially discharge into this catch basin. Consequently, the catch basin may be an area with residual contamination.

- Area of probable leakage identified in aerial photograph at what was to become northwest portion of Building 4359. If radioactive materials were released, residual contamination may exist.

- Drainage pathways associated with the Building 4359 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.6 Building 4360 Area

Site Description: The Building 4360 area comprises Building 4360 and the land surrounding it on the corner of B Street and 20th Street. Building 4360 was constructed in 1982 as the Sodium Component Test Installation (SCTI) Chemical Storage Building.[1,2] The SCTI Complex included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756.[3] Building 4360 was located north of SCTI Buildings 4361 and 4656, and west of SCTI Building 4362. These buildings are discussed elsewhere in this section.[4] Figures 2.2.6a through 2.2.6b provide a current photograph and the best available building-specific drawing(s) that the research team could find. No as-built drawings were located for Building 4360. Plate 1 presents a summary of all identified features for this site.

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[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-37.
[3] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[4] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

Building Features: Building 4360 was a steel-framed building with a steel roof and siding. It measured 384 square feet. Building 4360 did not contain any restrooms or heating and ventilation features. The ceiling height was 14 feet.[1] A sanitary sewer map shows a sewer line that forms a "T" at the intersection of B and 20th Street. Building 4360 is located at the southeast corner of this intersection.[2] Features of the SCTI area to the south of Building 4360 are depicted in Figure 2.2.6b.

Former Use(s): Building 4360 was the SCTI Chemical Storage Building. The SCTI complex was a development test facility for liquid metal (sodium) system components. The facility provided a test site for the non-nuclear developmental testing of typical liquid metal reactor components, primarily steam generators.[3]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 1999.[4] Building structures were removed followed by the below-grade pipes, ducts, trenches, tanks and pits. It doesn't appear that there were any large pits associated with Building 4359. The exact dimensions of the excavation are unknown. Backfilling and grading used on-site soil, possibly from the Area IV borrow area.[5,6]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4360 have not been conducted. At demolition and prior to disposition, liquid sodium from the SCTI complex was tested for radioactivity and reportedly found to be free of contamination.[7]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4360 is first identified in a 1980 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. Aerial photographs from 1980 through 1995 denote possible storage tanks and overhead pipes in PA-1.

[1] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-37.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-23.
[3] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-35.
[5] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.
[6] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.
[7] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-35.

Open storage areas are noted in PA-1 in 1980, and 1995. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4360 was no longer present in PA-1.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4360. Radionuclides associated with potential migration from SNAP Building 4019 include: americium-241 (Am-241), cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[2,3] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of the radiological contaminants of concern.

Drainage Pathways: A storm drainage culvert appears to cut across the Building 4360 site from B Street to 20th Street.[4] Aerial photographs from 1965 to 2005 show drainage flowing south from 20th Street and continuing into Area III impoundments.[5] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction and Building 4360 is located at the corner of 20th Street, runoff from SNAP Building 4019 could potentially impact Building 4360. The SNAP building handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4360.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, there is a possibility that radionuclide

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.
[3] Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853462.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4360 area. This includes the following Building 4360 areas:

- Sanitary sewer located north and west of the Building 4360 footprint. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Storm drainage that appears to cut across the Building 4360 footprint. Storm water originating from Building 4019 could discharge into this storm drain. Consequently, this storm drain may provide a pathway for the migration of radionuclides and residual contamination may exist in the area.

- Drainage pathways associated with the Building 4360 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.7 Site 4361 Area

Site Description: The Building 4361 area comprises Building 4361 and the land surrounding it west of 20th Street. Building 4361 was constructed in 1981 as the Sodium Component Test Installation (SCTI) Hazardous Material Storage Building.[1,2] The SCTI Complex included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756.[3] Building 4361 was located adjacent to SCTI Cooling Tower 4656 and west of SCTI Building 4356. Figures 2.2.7a through 2.2.7b provide a current photograph and the best available building-specific drawing(s) that the research team could find. Building 4361 was located northwest of SCTI Building 4392, which, along with the other SCTI buildings, is discussed elsewhere in this section. No as-built drawings were located for Building 4361. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4361 was a steel-framed building with a steel roof and siding. It measured 936 square feet. It did not contain any restrooms or heating and ventilation features. The ceiling height was 12 feet.[4] Features of the SCTI area surrounding Building 4361 are depicted in Figure 2.2.7b. This figure shows that Building 4361 was located west of a secondary containment pit and trench, south of numerous SCTI tanks, and east of the Building 4656 Cooling Tower.

Former Use(s): Building 4361 is identified as the SCTI Hazardous Material Storage Building.[5] The SCTI complex was a development test facility for liquid metal (sodium) system components.

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[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-37.
[3] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-37.
[5] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.

The facility provided a test site for the non-nuclear developmental testing of typical liquid metal reactor components, primarily steam generators.[1]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 2003.[2] SCTI building structures were removed followed by the below-grade pipes, ducts, trenches, tanks and pits. It doesn't appear that there were any large pits associated with Building 4361; however, there was a large secondary containment pit located east of Building 4361. The exact dimensions of the excavation are unknown. Backfilling and grading used on-site soil, possibly from the Area IV borrow area.[3,4]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): During demolition, Building 4361 debris was surveyed daily for total and removable contamination. No radiological contamination reportedly was detected. At demolition and prior to disposition, liquid sodium from the SCTI complex was tested for radioactivity and reportedly found to be free of contamination.[5]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4361 is identified on a 1988 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. Aerial photographs from 1988 and 1995 denote storage tanks and overhead pipes in PA-1. In 1995, an open storage area and probable stain are noted in PA-1. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4361 was no longer present in PA-1.[6]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4361. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Building 4019 include: americium-241 (Am-241), cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-37.

[3] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.

[4] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.

[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-37.

[6] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

and enriched uranium (U-234, U-235, U-238).[1,2] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of contaminant of concern.

Drainage Pathways: A storm drainage culvert is located just south of Building 4361 and drains to 20th Street.[3] Aerial photographs from 1965 to 2005 show drainage flowing south from 20th Street and continuing into Area III impoundments. Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[4] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[5,6] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Building 4019 could potentially impact Building 4361. The SNAP building handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4361.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, there is a possibility that radionuclide concentrations in soil will exceed the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the original Building 4361 area. This includes the following Building 4361 areas:

- Former secondary containment pit and trench located east of the Building 4361 footprint. If radiological materials migrated or were released into the pit or trench drainage system, residual contamination may exist in the area.

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.
[2] Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853462.
[3] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Storm drainage channel located south of the Building 4361 footprint. The storm drain collects storm water from former SNAP Building 4019. Residual contamination from the storm drain may exist.

- Drainage pathways associated with the Building 4361 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.8 Building 4362 Area

Site Description: The Building 4362 area comprises Building 4362 and the land surrounding it south of B Street. Building 4362 was used as the Sodium Component Test Installation (SCTI) Water Sampling Enclosure. The SCTI Building Complex was constructed between 1959 and 1964 and included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756.[1,2] Building 4362 was located north of SCTI Buildings 4356, 4361, and 4656, and east of SCTI Building 4360. These buildings are discussed elsewhere in this section. Figure 2.2.8a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4362. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4362 was a small structure, approximately 200 square feet.[3] A sanitary sewer map shows a sewer line located north of Building 4362.[4]

Former Use(s): Building 4362 was used to test the water used in the SCTI facility for purity. The SCTI complex was a development test facility for liquid metal (sodium) system components. The facility provided a test site for the non-nuclear developmental testing of typical liquid metal reactor components, primarily steam generators.[5,6]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 2003.[7] SCTI building structures were removed followed by the below-grade pipes, ducts, trenches, tanks and pits. It doesn't appear that there were any large

[1] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-39.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-39.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-23.
[5] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[6] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-39.
[7] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-39.

pits associated with Building 4362. The exact dimensions of the excavation are unknown. Backfilling and grading used on-site soil, possibly from the Area IV borrow area.[1,2]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): During demolition, Building 4362 debris was surveyed daily for total and removable contamination. No radiological contamination reportedly was detected. At demolition and prior to disposition, liquid sodium from the SCTI complex was tested for radioactivity and reportedly found to be free of contamination.[3]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4362 is so small it is difficult to identify specifically on aerial photographs. Building 4362 is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4026 was no longer present in PA-1. In 1978 and 1980 a large stained area is located southwest of Building 4026 and outside the PA-1 area.[4]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4362. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium (H-3), and natural and enriched uranium (U-234, U-235, U-238).[5,6,7] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

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[1] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.

[2] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.

[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-39.

[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.

[6] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.

[7] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.

Drainage Pathways: A storm drainage culvert is located north of Building 4263 and runs southwest to 20th Street.[1] Aerial photographs from 1965 to 2005 show drainage flowing south from 20th Street and continuing into Area III impoundments. Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[2] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[3,4] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012, could potentially impact Building 4362. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4362.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4362 area. This includes the following Building 4362 areas:

- Sanitary sewer located north of the Building 4362 footprint. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Storm drainage channel located north of the Building 4362 footprint. The storm drain collects storm water from former SNAP Building 4019. Residual contamination from the storm drain may exist.

[1] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Drainage pathways associated with the Building 4362 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.9 Building 4392 Area

Site Description: The Building 4392 area comprises Building 4392 and the land surrounding it. Building 4392 was constructed between 1987 and 1991 as the Sodium Component Test Installation (SCTI) Electrical Equipment Building.[1,2] The SCTI Complex included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756.[3] Building 4392 was located south of SCTI Buildings 4356, 4361, and 4656, west of SCTI Building 4359, and west of Small Component Test Loop (SCTL) Buildings 4026 and 4226. These buildings are discussed elsewhere in this section. Figure 2.2.9a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4392. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4392 was a metal-framed building with corrugated sheet metal roofing and siding. It measured approximately 400 square feet.[4]

Former Use(s): Building 4392 was an electrical equipment building for the SCTI complex. It served as the electrical control for the H-2 Heater. The SCTI complex was a development test facility for liquid metal (sodium) system components. The facility provided a test site for the non-nuclear developmental testing of typical liquid metal reactor components, primarily steam generators.[5,6]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished by 2003.[7] SCTI building structures were removed followed by the below-grade pipes, ducts, trenches, tanks and pits. It doesn't appear that there were any large

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[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Correspondence from Mattera, N.L., The Boeing Company, to Brown, A., Ventura County Air Pollution Control Division, *Reference: Sodium Component Test Installation (SCTI) Facility Demolition Project, Building 4392 and 4359 at the Santa Susana Field Laboratory (SSFL),* April 6, 2000.
[3] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[4] Correspondence from Mattera, N.L., The Boeing Company, to Brown, A., Ventura County Air Pollution Control Division, *Reference: Sodium Component Test Installation (SCTI) Facility Demolition Project, Building 4392 and 4359 at the Santa Susana Field Laboratory (SSFL),* April 6, 2000.
[5] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[6] Correspondence from Mattera, N.L., The Boeing Company, to Brown, A., Ventura County Air Pollution Control Division, *Reference: Sodium Component Test Installation (SCTI) Facility Demolition Project, Building 4392 and 4359 at the Santa Susana Field Laboratory (SSFL),* April 6, 2000.
[7] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

pits associated with Building 4392. The exact dimensions of the excavation are unknown. Backfilling and grading used on-site soil possibly from the Area IV borrow area.[1,2]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4392 were not conducted. The Building 4392 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4392. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[3]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4392 is first identified on a 1988 aerial photograph. In 1995, it is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1995 aerial photograph denotes storage tanks, overhead pipes, open storage areas, and a probable stain in PA-1. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4392 was no longer present in PA-1.[4]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4392. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium

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[1] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.
[2] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.
[3] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

(H-3), and natural and enriched uranium (U-234, U-235, U-238).[1,2,3] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A storm drain culvert was located north of Building 4392 and ran southwest to 20th Street.[4] Aerial photographs from 1965 to 2005 show drainage flowing south from 20th Street and continuing into Area III impoundments. Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum. The 17th Street Drainage is discussed later in this section.[5] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could have impacted the Building 4392 area. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4392.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the original Building 4392 area. This includes the following Building 4362 areas:

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[2] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[3] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Storm drainage channel located north of the Building 4392 footprint. The storm drain may have collected storm water from former SNAP Buildings 4010 and 4012. Residual contamination from the storm drain may exist.

- Drainage pathways associated with the Building 4392 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.10 Building 4457 Area

Site Description: The Building 4457 area comprises Building 4457 and the land surrounding it on B Street. Building 4457 was constructed between 1971 and 1972 as the Sodium Component Test Installation (SCTI) Pump Bearing Test Structure. The SCTI Complex included Buildings 4355, 4356, 4357, 4359, 4360, 4361, 4362, 4392, 4457, 4656, and 4756. Building 4457 was located south of B Street near SCTI Buildings 4355 and 4357 and Support Trailer Building 4478.[1,2,3] These buildings are discussed elsewhere in this section. Figures 2.2.10a through 2.2.10b provide a current photograph and the best available building-specific drawing(s) that the research team could find. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4457. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4457 was a two-story building.[4] The building had three subsurface emergency containment sumps for sodium components. Sump 1 was a sodium drain tank containment sump approximately 27 feet long by 14 feet wide by 10 feet deep. Sump 2 was a sodium pump tank containment sump approximately 12 feet long by 12 feet wide by 14 feet deep. Sump 1 and 2 were connected by a 2 foot-wide by 2 foot-deep trench. Sump 3 was a sodium cold trap containment sump approximately 4 feet long by 4 feet wide by 4 feet deep. During the 1980s, Sump 1 was backfilled with soil and capped with concrete. Concrete berms were placed around the perimeter. The berms later served as secondary containment for the storage of hazardous materials. In a 2000 Resource Conservation and Recovery Act Facility Investigation Work Plan Addendum, the concrete was noted as having evidence of cracks within the containment area. During the 1970s and 1980s, Sump 2 received rainwater, waste oils, and possibly solvents from spills or leakage of hazardous material containers. In the 1980s, the sump was emptied, backfilled with soil, and capped with concrete. Sump 3 was a physical low spot for sodium processes. Hazardous chemicals reportedly were not used or disposed in this sump. It was filled with concrete and capped following building demolition activities.[5]

Former Use(s): Building 4457 was used for proof and performance testing of sodium lubricated bearings used in large sodium pumps. In July 1972, a shaft seal failed, causing oil to

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[1] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-43.
[3] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-43.
[5] Ogden Environmental and Energy Services Co., Inc., *RCRA Facility Investigation Work Plan Addendum Amendment, Santa Susana Field Laboratory, Ventura County, California*, June 2000, pgs. 7-1–7-2.

contaminate the sodium system. Attempts to clean and repair the system failed. Building 4457 was subsequently gutted and used for storage of waste oils from non-radiological facilities. Hazardous materials stored in the area of 4457 included acids, bases, solvents, and petroleum-based oils and lubricants. By 1996, Building 4457 was listed as "foundation only."[1,2,3]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: The foundation was removed in 1999.[4] SCTI building structures were removed followed by the below-grade pipes, ducts, trenches, tanks and pits. It doesn't appear that there were any large pits associated with Building 4457. The exact dimensions of the excavation are unknown. Backfilling and grading used on-site soil possibly from the Area IV borrow area.[5,6]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4457 were not conducted. The Building 4457 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4457. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[7]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4457 is first identified in a 1972 aerial photograph. It is located in a hazardous material storage area (HMSA) within a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings

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[1] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, pgs. 5, 13.
[2] Ogden Environmental and Energy Services Co., Inc., *RCRA Facility Investigation Work Plan Addendum Amendment, Santa Susana Field Laboratory, Ventura County, California*, June 2000, pgs. 7-1–7-2.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-43.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-43.
[5] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.
[6] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.
[7] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

are included in the HMSA, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. By 1978, a probable open storage area was observed in the HMSA containing approximately six to eight objects. In 1980, probable staining was observed, and in 1983 and 1987 an area of dark-toned material was visible. In 1990 and 1992, areas of possible staining were noted in the HMSA. By 1993, this area no longer appeared active. In 1998, approximately 12 containers were observed at this location. By 2002, the containers and the building had been removed from the HMSA.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4457. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[2,3,4] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[5] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4457. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4457.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, possible and probable stains noted in aerial photographs, and lack of site investigation.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[3] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790,* Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[4] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation, stains noted in aerial photographs, and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the original Building 4457 area. This includes the following Building 4457 areas:

- Former containment sumps in the Building 4457 area. If radiological materials migrated or were released into the pit, residual contamination may exist in the area.

- Low-lying areas south and east of Building 4457 footprint included in the HMSA where recessed areas were identified in aerial photographs. Low-lying areas could collect possible radioactive drainage from Buildings 4010 and 4012 and may contain residual contamination.

- Possible and probable stained areas identified in aerial photographs south and east of the Building 4457 footprint. Unknown stains could possibly contain residual contamination.

- Drainage pathways associated with the Building 4457 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.2.11 Building 4478 Area

Site Description: The Building 4478 area comprises Building 4478 and the land surrounding it on B Street. Building 4478 was first identified on a 1967 industrial planning map as an office support trailer located east of the Hot Laboratory Building 4020, discussed in Subarea HSA-5D. Between 1967 and 1971, Building 4478 was moved from its original location to a position on B Street, northeast of Sodium Component Test Installation (SCTI) Buildings 4357 and 4457.[1,2] These buildings are discussed elsewhere in this section. Figure 2.2.11a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4478. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4478 was a dual axis 8-foot by 30-foot office trailer.[3]

Former Use(s): Building 4478 was originally used as a support trailer. By 1971, the building was used to service the SCTI. The SCTI complex was a development test facility for liquid

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-47.
[2] SSFL Area IV, Atomics International Nuclear Development Field Laboratories, Industrial Planning Maps, January 1967, April 1971.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-47.

metal (sodium) system components. The facility provided a test site for the non-nuclear developmental testing of typical liquid metal reactor components, primarily steam generators. By 1981, Building 4478 was used for radioactive count analysis.[1,2]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished.[3] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): At demolition and prior to disposition, liquid sodium from the SCTI complex was tested for radioactivity and reportedly found to be free of contamination. Since radiological materials were not handled in Building 4478 and no contamination occurred, no further tests were conducted.[4]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4478 is first clearly visible in a 1980 aerial photograph. It is located in a hazardous material storage area (HMSA) within a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in the HMSA, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. In 1978, a probable open storage area was observed in the HMSA containing approximately six to eight objects. In 1980, probable staining was observed, and in 1983 and 1987 an area of dark-toned material was visible. In 1990 and 1992, areas of possible staining were noted in the HMSA. By 1993, this area no longer appeared active. In 1998, approximately 12 containers were observed at this location. By 2002, the containers and the building had been removed from the HMSA.[5]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4478. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-

[1] Kneff, D.W. et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, October 1, 2003, p. 5.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-47.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-47.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-47.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

3, U-234, U-235, and U-238.[1,2,3] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[4] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[5,6] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4478. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4478.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, possible and probable staining noted in aerial photographs, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation, possible and probable staining noted in aerial photographs, and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4478 area. This includes the following Building 4478 areas:

- Northern and western edges of the Building 4478 footprint nearest B Street. Possible storm drainage from Buildings 4010 and 4012 may have contaminated the area.

- Possible and probable stained areas identified in aerial photographs south of the Building 4478 footprint. Unknown stains could possibly contain residual contamination.

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[2] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[3] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Drainage pathways associated with the Building 4478 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.3 Group 3

The Group 3 index map is presented in Figure 2.3. Following Figure 2.3, the site photograph and layout drawings for each building area within HSA-5B Group 3 are presented. HSA-5B Group 3 includes six building areas containing the Building 4006 Sodium Laboratory, the Building 4606 and 4607 Sodium Laboratory Instrument Buildings, the Building 4615 Combustion Test Facility, the Building 4402 MHD Experiment Building, and Parking Lot 4506.

2.3.1 Building 4006 Area

Site Description: The Building 4006 area comprises Building 4006, Cooling Tower 4616, Electrical Substation 4706, an unknown Building 4477, and the land surrounding these buildings on the west side of 17th Street. Building 4006 was constructed between 1957 and 1959 as a sodium laboratory. Cooling Tower 4616 associated with Building 4006 was removed in the early 1980s to make room for a Power Pak associated substation.[1,2,3] Figures 2.3.1a through 2.3.1c provide a current photograph and the best available building-specific drawing(s) that the research team could find. Figure 2.3.1b is an as-built elevation and section drawing of Building 4006. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4006 has a steel frame and walls. It measures approximately 13,284 square feet and includes 2,268 square feet of office space and 7,674 square feet of lab space.[4] An active septic tank near Building 4006 was identified in 1999. Rocketdyne planned to abandon the septic tank and connect Building 4006 to an existing sewer system. Presumably, this is the Building 4006 septic tank that was removed in 2000. The location of the former septic tank is currently unknown, but presumably on the southwest side of the building near the sanitary sewer connection. The Building 4005/4006 leach field (identified as AI-Z8) had two underground septic tanks (Building 4005 septic tank and Building 4006 septic tank) with 2,340-gallon capacities and a 480 linear feet leach field. It was located in Parking Lot 4502, approximately 550 feet southwest of Building 4005 and 150 feet northeast of Building 4062. Although Building 4005 handled depleted and enriched uranium for nine months in 1966-1967, it is not likely to have impacted the Building 4005/4006 leach field as the leach field was disconnected and abandoned in 1960-1961 when the sewer treatment plant was constructed. The Building 4005/4006 leach field and drain lines were removed in 2001.[5,1,2,3,4]

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.

[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-5.

[4] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.

[5] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV Santa Susana Field Laboratory, Ventura County, California, Part 1-Current Conditions Report, Volume 1*, October 1993, pgs. 4-83, 4-87.

A 1974 engineering drawing depicts a supply and drain tank (T-102) and an additional storage and drain tank (T-301) associated with Building 4006. See Figure 2.3.1c. The exact location of these tanks is not clear.

Former Use(s): Building 4006 was operated as a non-nuclear sodium laboratory. Use Authorizations provided for minor uses of radioactive materials. Cooling Tower 4616 was removed in the early 1980s to make room for a Power Pak associated substation. Building 4006 closed operations in 1999.[5]

Information from Interviewees: A number of former employees were interviewed about their experience at the SSFL. Three remembered Building 4006. Excerpts from their interviews are included below.

Interviewee 101 was an Atomics International employee from 1986 to 1997. The interviewee was a manager of system and test activities in the Engineering Department. The following excerpt was pulled from the interview.

> *"There was once a sodium leak on the floor from the Building 006 sodium loop, to which the SSFL fire department responded. Other than that, I am unaware of areas that may require cleanup."* [6]

Interviewee 110 was a member of the technical staff at SSFL who designed and tested high temperature liquid sodium systems, but did not recall working on anything radioactive. The following excerpts were pulled from the interview.

> *"Anyhow, having gotten hooked on this sodium stuff, I went to Building 6 (the Sodium Laboratory) where there were three or four sodium loops and I managed testing that went on there for some time. I also designed one of the loops. Building 6 is still there – I remember driving by it when I took the tour last year. Eventually in the late 70's I became Lead Engineer for the sodium purification system – I was the man who knew all about it. But not everyone agreed with me in terms of technical disputes! I trained outsiders such as people from DOE on one of the loops in Building 6 to give them a taste of what it was like to operate a sodium system. They actually got to operate a loop. With respect to Building 6,*

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, pgs. O-2, O-5–O-6.
[2] Correspondence from Lenox, A., The Boeing Company, to Evans, J., Ventura County Environmental Health Division, *Reference: Building 4006 Septic Tank Abandonment, Boeing North American, Santa Susana Field Laboratory, Ventura County, California*, June 14, 1999.
[3] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume V – RFI Site Reports, Appendix I, Coal Gasification Process Development Unit*, CH2M Hill, Draft in Progress November 2008, p. Table I.2-4.
[4] Correspondence from Lee, M., The Boeing Company, to Richards, A., U.S. Department of Energy, *Reference: DE-AC03-99SF21530, Environmental Restoration and Remediation of the former Energy Technology Engineering Center (ETEC) Site Reporting Requirements Checklist FY00 Performance Milestones 00-4, Soil and Groundwater, removal of three septic tanks, 7/30/00*, September 12, 2000.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-5.
[6] Interview No. 101 conducted by DOE in 2010.

> *as an example, the company did not have a strong sense that people performing these tasks should be heavily trained and follow well thought out procedures. The people who preceded me in Building 6 did everything from memory. There were no recorded procedures until I came along. I wrote procedures detailed enough so that my secretary could operate the equipment.*
>
> *Sodium was easy to get rid of and its by-products are non-toxic. Improper disposal did not occur in areas where I worked and frankly, I was one of those people that if anyone had proposed of doing anything stupid like that I would have gone ballistic!"* [1]

Interviewee 277 started working at SSFL in May 1975 as a technician in Building 4006 for Atomic International's Sodium & Component Technology Group. The interviewee was transferred 2 to 3 years later to work at the RMHF. The following excerpts were pulled from the interview.

> *"At Building 006 I worked for IKL – he brought me in to the chemistry lab. I always kept a notebook as to what I did on experiments. I would turn the notebook in to the Engineer or Department Head. We would take samples. JLM worked on sensitizing stainless steel by putting it in different acid baths like acetic or nitric. The samples would go in the sodium loop and it would be run for a number of hours and then we would look at them to see if the sodium was still adhered to the stainless steel. We would see how we could clean the samples to test how well the sodium bonded."* [2]

Radiological Incident Reports: There has been one incident associated with Building 4006. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4006 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0484	8/11/1960	BLDG MET LAB	AP	POLISHING SAMPLES OF SRE MODERATOR CAN CONTAMINATED CLEAN AREA.

- In addition to the incident described in Boeing's database, a 2008 Resource Conservation and Recovery Act Facility Investigation report describes other incidents associated with Building 4006, including a sodium fire on November 25, 1987 resulting in a release of sodium metal, a mercury spill in a sink on January 21, 1992, and a tetralin fire on August 16, 1959.[3]

[1] Interview No. 110 conducted by DOE in 2010.
[2] Interview No. 277 conducted by DOE in 2010.
[3] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume V – RFI Site Reports, Appendix I, Coal Gasification Process Development Unit*, CH2M Hill, Draft in Progress November 2008, p. Table I.2-1.

Current Use: Building 4006 is standing as of 2010, but is no longer in use.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): A chronology of radiological investigations at this building is as follows:

- **2001 Boeing Soil Sampling**. Soil sampling was performed during excavation of the leach field, septic tanks, and drain lines in 2001. No contamination was reportedly detected.[1,2]
- **2008 Boeing Radiological Survey**. In 2008, The Boeing Company performed a radiological survey to verify that Building 4006 met release criteria for unrestricted use. Exposure rate measurements, surface scans, and smear samples were taken at targeted locations. Exposure rate measurements were below the acceptable limit of 5 microroentgens per hour (μR/hr) above natural background. Surface residual radioactivity levels were below the 2008 acceptable limits identified in the table below. Building 4006 was recommended for release.[3]

Surface Residual Radioactivity Guidelines for SSFL Facilities

Radionuclide	Type of Radiation	Average over 1 m^2 (dpm/100 cm^2)	Maximum over 100 cm^2 (dpm/100 cm^2)	Removable (dpm/100 cm^2)
Uranium (U-234, U-235, U-238)	**Alpha**	**5,000**	**15,000**	**1,000**
Mixed Fission Products (Cesium-137)	**Beta, Gamma**	**5,000**	**15,000**	**1,000**
Activation Products (Manganese-54)	**Beta, Gama**	**5,000**	**15,000**	**1,000**
Tritium	**Beta**	**---**	**---**	**10,000**

Radiological Use Authorizations: Radiological Use Authorizations for Building 4006 include the following:

- Use Authorization No. 66 (September 28, 1973) specified that sodium (Na) would be added to canisters containing uranium oxide (UO_2) in Building 4006.[4]

- Use Authorization No. 81 (June 26, 1974) permitted the use of tritiated titanium (H-3) foils (i.e, a thin, sheet of metal) as gas chromatograph detectors. The foils were declared excess in 1986 and removed from the building.[5]

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 –Area IV Site Summaries*, May 2005, pgs. O-5–O-6.
[2] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[3] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-5.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-5.

- Use Authorization No. 101 (April 8, 1976) permitted the handling of 0.5 microcuries (μCi) of manganese-54 (Mn-54) contained in sections of activated piping with frozen sodium. This piping was packaged in aluminum piping; the unpacking occurred in Building 4006.[1]

Former Radiological Burial or Disposal Locations: None found.

Aerial Photographs: Building 4006 is first identified in a 1959 aerial photograph. It is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's (EPA's) aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1959 aerial photograph shows a possible stain just north of Building 4006. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. In 2005, Building 4006 is one of only two buildings observed in PA-1.[2]

Radionuclides of Concern: Building 4006 was predominantly a non-radiological facility, but there are records of minor uses of radioactive materials, including UO_2, Mn-54, H-3 foils in gas chromatographs, and sodium loop level gauges possibly employing cesium-137 (Cs-137) sources. Radionuclides that may be present as a result of residual radioactivity in Building 4006 include: Cs-137, Mn-54, H-3, and natural and enriched uranium (U-234, U-235, U-238).[3] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010, 4012, and 4024 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, and U-234, U-235, U-238.[4,5,6] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A lined drainage channel following 17th Street to the southeast begins approximately 100 feet southeast of Building 4006.[7] A 1988 memorandum references a Building

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-5.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[5] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[6] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, pgs. 5, 10.
[7] Map located at: http://dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

4006 ditch that leads to the G and 17th Street exit.[1] Aerial photographs from 1957 to 2005 indicate that drainage followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[2] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[3,4] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010, 4012, and 4024 could potentially impact Building 4006. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4006.

Radiological Contamination Potential: Class 2 because regulated radiological material was handled in Building 4006, aerial photograph analysis noted possible stains, and there is potential for radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010, 4012, and 4024.

Recommended Locations for Sediment/Soil Sampling:

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

Due to regulated radiological material use, possible stains noted in aerial photographs, and the potential of radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010, 4012, and 4024, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4006 area. This includes the following Building 4006 areas:

- Former Building 4006 septic tank area presumably on the southwest side of the building. If radioactive materials were released into the septic system, residual contamination may exist in the materials surrounding the former septic tank.

- Former Building 4005/4006 leach field west of the Building 4006 footprint. If radioactive materials were released into the septic system, residual contamination may exist in the materials surrounding the former leach field.

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[1] Memorandum from Fujikawa, N., to Those Concerned, *Reference: SCTI Support*, October 14, 1988, HDMSE00600015.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Drainage pathway along 17th Street, east of the Building 4006 footprint. If radioactive materials drained from the SNAP facilities to the north, residual contamination may exist along the 17th Street drainage east of Building 4006.

- Building 4006 ditch, if location can be determined. If radioactive materials were released into the ditch, residual contamination may exist in the surrounding the area.
- Area north of Building 4006 where a possible stain is noted in aerial photograph. An unknown stain could be a potential source of contamination.

- Drainage pathways associated with the Building 4006 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.3.2 Building 4402 Area

Site Description: The Building 4402 area comprises Building 4402 and the land surrounding it west of 17th Street. Building 4402 was constructed between 1964 and 1967 and is identified on industrial planning maps as the MHD Experiment. It is last identified on a March 1975 industrial planning map. Building 4402 was a small structure located between Hydrogen Recombiner Test Canopy Building 4816 and Sodium Laboratory Instrument Building 4607.[1,2] These buildings are discussed elsewhere in this section. Figure 2.3.2a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4402. Plate 1 presents a summary of all identified features for this site.

Building Features: No information was located.

Former Use(s): Building 4402 was a non-radiological facility.[3] No other information could be located.

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished.[4] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4402 were not conducted. The Building 4402 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-9.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-9.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-9.

Survey. A walkabout gamma survey was conducted in the area of Building 4402. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4402 is first clearly visible in a 1967 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. Aerial photographs from 1967 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995, but Building 4402 is no longer present in PA-1.[2]

A 1978 aerial photograph identifies a probable horizontal tank and possible leakage causing a stain located southeast of Building 4402 and outside of PA-1. A 1980 aerial photograph notes that a drainage path follows along a dirt road that travels southeast along the west side of Building 4402 and curves east toward 17th Street. A large probable stained area is located southeast of Building 4402 and outside of PA-1, where the drainage appears to run before reaching 17th Street.[3]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4402. Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[4] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and

[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.

4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[1,2,3] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A 1980 aerial photograph notes that a drainage path follows along a dirt road that travels southeast along the west side of Building 4402 and curves east toward 17th Street. Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[4] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[5,6] Because the general slope of Area IV is in a southerly direction, runoff from Sodium Laboratory Building 4006, and SNAP Buildings 4010 and 4012 could potentially impact Building 4402. Building 4006 had minor use of radioactive materials. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4402.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010 and 4012, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the potential of radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012, and the lack of site investigation, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4402 area. This includes the following Building 4402 areas:

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[2] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790,* Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[3] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Drainage pathway located west and south of the Building 4402 footprint. If radioactive materials drained from facilities to the north, residual contamination may exist along the drainage pathways west and south of Building 4402.

- Stained area identified on aerial photographs located southeast of the Building 4402 footprint. An unknown stain could be a potential source of contamination.

- Drainage pathways associated with the Building 4006 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.3.3 Parking Lot 4506 Area

Site Description: The Parking Lot 4506 area comprised Parking Lot 4506 and the land surrounding it between 17th Street and the eastern side of Building 4006. Parking Lot 4506 was first identified by name on a 1967 industrial planning map. However, a 1959 aerial photograph shows the area being used as a parking lot. The site served as a parking lot for Buildings 4005, 4006, 4024, 4025, and adjacent facilities.[1,2,3] Figure 2.3.3a provides a current photograph. The research team was unable to find building-specific drawing(s). Buildings east of 17th Street are discussed in the Subarea HSA-5A TM. Buildings 4606, 4607, 4615, and 4816 are discussed elsewhere in this section. No as-built drawings were located for Parking Lot 4506. Plate 1 presents a summary of all identified features for this site.

Building Features: No information was located.

Former Use(s): Parking Lot 4506 is a parking lot servicing Buildings 4005, 4006, 4024, 4025, and adjacent facilities.[4]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: The parking lot is still present in 2010.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Parking Lot 4506 were not conducted. The Parking Lot 4506 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the Parking Lot 4506 area. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-11.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-11.

report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Parking Lot 4506 appears on a 1959 aerial photograph. In 1978, a large stained area is noted south of the parking lot. A probable stain is located in the same area south of Parking Lot 4506 in 1980. In 1983 and 1988, a pipeline is identified south of Parking Lot 4506 running southeast along 17th Street. By 1995, the portion of the pipeline nearest the parking lot has been removed. The Parking Lot is still visible in a 2005 aerial photograph.[2]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Parking Lot 4506. Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[3] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[4,5,6] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[5] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[6] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.

Drainage Pathways: A lined drainage channel runs southeast along 17th Street from the south end of the parking lot.[1] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[2] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[3,4] Because the general slope of Area IV is in a southerly direction and drainage follows 17th Street along the east side of Parking Lot 4506, runoff from SNAP Buildings 4010, 4012, and 4024 could potentially impact Parking Lot 4506. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Parking Lot 4506.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, 4012, and 4024, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the potential of radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, 4012, and 4024, and the lack of site investigation, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Parking Lot 4506 area, including the drainage pathways associated with the Building 4006 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.3.4 Building 4606 Area

Site Description: The Building 4606 area comprises Building 4606, Hydrogen Recombiner Test Building 4816, and the land surrounding these buildings. Building 4606 was constructed prior to March 1962 and was identified as Sodium Laboratory Instrument Building A. It was a small structure located off 17th Street south of Building 4006.[5,6] Figures 2.3.4a through 2.3.4d provide a current photograph and the best available building-specific drawing(s) that the research

[1] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-13.
[6] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

team could find. Sodium Laboratory Building 4006 and its associated structures, Sodium Laboratory Instrument Building 4607, and MHD Experiment Building 4402 are discussed elsewhere in this section. Figure 2.3.4b presents a wireway diagram for Buildings 4606 and 4816. Figure 2.2.4c presents an electrical plan for the Building 4606 yard area. Figure 2.2.4d presents an as-built drawing for Hydrogen Recombiner Test Building 4816 and its roof extension. Plate 1 presents a summary of all identified features for this site.

Building Features: Figure 2.3.4c notes there was an electric substation west of Building 4606.[1] Figure 2.3.4d notes that Building 4816 had two bays measuring 15 feet by 30 feet.[2]

Former Use(s): Building 4606 was initially identified as Sodium Laboratory Instrument Building A. In 1972, the building was identified as MHD Support Building. By 1975, the building was identified as the Hydrogen Recombiner Test Building and retained this designation through the early 1990s.[3] As the Hydrogen Recombiner Test Building, Building 4606 was used to test the capacity of the Hydrogen Recombiner, a devise developed by Atomics International to mix the hydrogen and regular air to create water, useful in an emergency situation if a reactor produced excess hydrogen.[4]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Building 4606 was demolished sometime after June 2005.[5,6] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4606 were not conducted. The Building 4606 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4606. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma

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1 *Susana Bldg 606 Yard Area Electrical Plan, 303-606-E2*, Rockwell International, Unknown Date.
2 *Santa Susana Facility Bldg Hydrogen Recombiner Test Facility Canopy Roof - Plan & Details, 303-816-S1*, Atomics International, Unknown Date.
3 Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
4 Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-13.
5 Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-13.
6 Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4606 is first identified as a new building in a 1978 aerial photograph, although there are structures located in the area prior to 1978. Building 4606 is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. Building 4606 is still standing in a 2005 aerial photograph.[2]

A 1978 aerial photograph identifies a probable horizontal tank and possible leakage causing a stain located southeast of Building 4606 and outside the PA-1 area. A 1980 photograph notes that drainage follows along a dirt road that travels southeast along the west side of Building 4606 and curves east toward 17th Street. A large probable stained area is located southeast of Building 4606, where the drainage appears to run before reaching 17th Street. The 1980 aerial photograph also notes a smaller stain south of Building 4606.[3]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4606. Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[4] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[5,1,2] All radionuclides of concern

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[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

[4] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.

[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.

listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A lined drainage channel following 17th Street to the southeast begins approximately 55 feet southeast of Building 4606.[3] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum. The 17th Street Drainage is discussed later in this section. A 1980 aerial photograph notes that drainage also follows along a dirt road that travels southeast along the west side of Building 4606 and curves east toward 17th Street.[4] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[5,6] Because the general slope of Area IV is in a southerly direction, runoff from Sodium Laboratory Building 4006 and SNAP Buildings 4010 and 4012 could potentially impact Building 4606. Building 4006 had minor uses of radioactive material. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4606.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010 and 4012, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the potential of radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012, and the lack of site investigation, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4606 area. This includes the following Building 4606 areas:

[1] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[2] Unknown Author, *Facility Information, Building 012,* Unknown Date, HDMSP001828011.
[3] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Drainage pathway located east and west of the Building 4606 footprint. If radioactive materials drained from facilities to the north, residual contamination may exist along the drainage pathways east and west of Building 4606.

- Stained area identified on aerial photographs located southeast of the Building 4606 footprint. An unknown stain could be a potential source of contamination.

- Drainage pathways associated with the Building 4006 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.3.5 Building 4607 Area

Site Description: The Building 4607 area comprises Building 4607 and the land surrounding it. Building 4607 was constructed prior to March 1962 and identified as Sodium Laboratory Instrument Building B. It was a small structure located off 17th Street, south of MHD Experiment Building 4402.[1,2] Figure 2.3.5a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings have been located for Building 4607. Plate 1 presents a summary of all identified features for this site.

Building Features: No information was located.

Former Use(s): Building 4607 was initially identified as the Sodium Laboratory Instrument Building B. In 1972, it was identified as a Storage Building. The last legible industrial planning map that specifically identifies Building 4607 is a 1982 map. Building 4607 was used for non-radiological storage.[3,4]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Building 4607 presumably was demolished in the 1980s.[5] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4607 were not conducted. The Building 4607 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4607. Only areas

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-15.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-15.
[4] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4607 is first identified in 1962/63 and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. Building 4607 cannot be identified on aerial photographs from 1983 and 1988 and is not visible on a 1995 aerial photograph.[2]

A 1978 aerial photograph identifies a probable horizontal tank and possible leakage causing a stain located southeast of Building 4607 and outside the PA-1 area. A 1980 photograph notes that drainage follows along a dirt road that travels southeast along the west side of Building 4607 and curves east toward 17th Street. A large probable stained area is located southeast of Building 4607, where the drainage appears to run before reaching 17th Street. The 1980 aerial photograph also notes a smaller stain in the vicinity of Building 4607.[3]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4607. Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[4] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and

[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.

4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[1,2,3] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A lined drainage channel following 17th Street to the southeast begins approximately 100 feet east of Building 4607.[4] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[5] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from Sodium Laboratory Building 4006 and SNAP Buildings 4010 and 4012 could potentially impact Building 4607. Building 4006 had minor uses of radioactive material. The SNAP buildings handled radioactive materials and generated radionuclides. This presents a possibility of radiological contamination in the area of Building 4607.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010 and 4012, stained area and possible leakage noted in aerial photographs, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation, potential of radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012, and stained area and possible leakage, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[2] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[3] Unknown Author, *Facility Information, Building 012,* Unknown Date, HDMSP001828011.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

characterization is recommended for the Building 4607 area. This includes the following Building 4607 areas:

- Drainage pathway located south and west of the Building 4607 footprint. If radioactive materials drained from facilities to the north, residual contamination may exist along the drainage pathways south and west of Building 4606.

- Stained area and possible leakage area identified on aerial photographs located southeast of the Building 4607 footprint. An unknown stain could be a potential source of contamination.
- Drainage pathways associated with the Building 4607 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.3.6 Building 4615 Area

Site Description: The Building 4615 area comprises Building 4615 and the land surrounding it near the intersection of B Street and 17th Street. Building 4615 was constructed in the early 1980s as a Combustion Test Facility. The structure was located north of Sodium Laboratory Building 4006.[1] Figure 2.3.6a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4615. Plate 1 presents a summary of all identified features for this site.

Building Features: No information was located.

Former Use(s): Building 4615 was identified as a Combustion Test Facility.[2]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished.[3] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4651 were not conducted. The Building 4615 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4615. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-17.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-17.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-17.

Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: A structure appears at the northeast end of Building 4006 in a 1978 aerial photograph, but it is not clear if this is Building 4615. Another structure appears at the northwest end of Building 4006 in 1980, but it is unclear if this is Building 4615. Building 4615 is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. In 1978, PA-1 contains possible storage tanks, overhead pipes, open storage, and a stain. In 1980 and 1983, a possible stain was noted in PA-1. No structures are visible north of Building 4006 in aerial photographs following 1980.[2]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4615. Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[3] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010, 4012, and 4024 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[4,5,6] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[5] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[6] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.

Drainage Pathways: A storm drainage culvert was located north of Building 4615 on B Street and east of Building 4615 on 17th Street.[1] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[2] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[3,4] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010, 4012, and 4024 could have impacted the Building 4615 area. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4615.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, 4012, and 4024, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

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

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, 4012, and 4024, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4615 area. This includes the following Building 4615 areas:

- Storm drainage channel located north and east of the Building 4615 footprint. The storm drain may have collected storm water from former SNAP Buildings 4010, 4012, and 4024. Residual contamination from the storm drain may exist.

- Drainage pathways associated with the Building 4615 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

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[1] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B,* Rockwell International Corporation, August 1993, p. b-25.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

2.4 Group 4

The Group 4 index map is presented in Figure 2.4. Following Figure 2.4, the site photograph and layout drawings for each building area within HSA-5B Group 4 are presented. HSA-5B Group 4 includes four building areas containing the Small Component Test Loop (SCTL) Complex buildings. The SCTL Complex is comprised of Buildings 4026, 4226, and 4826. Building 4358, originally built to support the Sodium Component Test Installation, was later moved to support the SCTL. As a result, Building 4358 will be discussed as appropriate in Group 2 and Group 4 of this section.

2.4.1 Building 4026 Area

Site Description: The Building 4026 area comprises Building 4026, Electrical Substation 4726, Time Clock Building 4805, Uninterruptible Power Supply (UPS) Building 4426, and the land surrounding these buildings. Building 4026, part of the SCTL complex, was originally built as part of the Large Component Test Loop (LCTL) complex in 1958. Building 4026 was constructed in 1960 as the SCTL Control Building and was located between 17th and 20th Streets.[1,2,3,4] Figures 2.4.1a through 2.4.1d provide a current photograph and the best available building-specific drawing(s) that the research team could find. Buildings 4026, 4226, and 4826 together comprised the SCTL complex.[5] Buildings 4226 and 4826 are discussed elsewhere in this section. Plate 1 presents a summary of all identified features for this site.

Building Features: The STCL complex was 10,340 square feet with a 9,659-square-foot laboratory and 681 square feet of non-laboratory space. The SCTL complex consisted of an enclosed component test area, a sodium transport and storage system, an instrument and control system, and other interfacing systems. The sodium transport and storage system consists of four test loops, a thermal conditioning loop, and two liquid sodium storage/drain tanks that act as reservoirs for normal and emergency draining.[6,7,8]

Building 4026 was the SCTL Control Building. The frame, siding, and roof were constructed of steel. The building area was approximately 11,522 square feet. It had a restroom and central air. Ceiling heights were 9 feet and 74 feet.[9] Building 4026 housed the control room, electrical

[1] U.S. Department of Energy, *Small Component Test Loop*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Sodium/SCTL.html, accessed November 25, 2009, p.1.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-1.
[3] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.
[4] *Technical Site Information Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-31.
[5] Rutherford, P.D., *Site Environmental Report for Calendar Year 1998 , DOE Operations at Rocketdyne Propulsion & Power, RD99-115,* The Boeing Company, Rocketdyne Propulsion & Power, September 22, 1999, p. 2-10.
[6] Cleveland, J.R., *Safety Hazards Report, GEN-ZR-0001*, Energy Technology Engineering Center, April 30, 1985, pg. 38.
[7] U.S. Department of Energy, *Small Component Test Loop*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Sodium/SCTL.html, accessed November 25, 2009, p.1.
[8] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-1.
[9] *Technical Site Information Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-31.

equipment rooms, and a motor generator room. The control room was a 20 foot by 40 foot room containing facility instrumentation, control panels and an operational console. Recorders, controllers and data loggers displayed facility and test conditions. The electrical equipment rooms were 20 feet by 18 feet, and 20 feet by 21 feet in size and housed the electrical switchgear, motor control components, and storage for tools and supplies.[1] The motor generator room is identified in a 1977 electrical drawing. A 1,250 horse power motor generator is identified west of the control and electrical rooms.[2] Figure 2.4.1b presents a floor plan of SCTL Buildings 4026 and 4826 and Figure 2.4.1c is an electrical drawing pertaining to Building 4026. A 1996 building reconnaissance report states Building 4026 did not have any water, sewer, or gas connections.[3]

At least five tanks have been associated with Building 4026, including two vaulted sodium tanks with open pit secondary containment. These sodium tank pits may actually have been located in Building 4826 based on Figure 2.4.1b. Four of the tanks were sodium tanks, ranging from 5,000 gallons to 12,000 gallons in capacity, and the fifth tank was a 125-gallon lube oil tank.[4] A 1966 drawing depicts a below-grade pipe running from a floor drain on the east side of Building 4359 to a catch basin located between Buildings 4026 and 4355.[5]

Former Use(s): The SCTL was originally built as the LCTL and operations began in 1959 with a pump test.[6] This facility was used to test small components such as valves and pumps in liquid sodium.[7] The SCTL's principal purpose was to provide a test bed for non-nuclear qualification testing of typical liquid metal fast breeder reactor components and to obtain test data for verification of the elevated temperature design criteria of the piping design guide. In 1970, the LCTL was modified, expanded, and re-designated as the SCTL. In 1974, the facility was again modified and expanded. In 1978, a new control room was added onto the northwest corner of the facility, giving the complex its final appearance. Testing within the facility continued periodically from 1959 until 1985. Upon completion of the test programs, the sodium was drained into the facility sodium drain tanks and all systems were secured. The facility was maintained in inactive standby status, with the sodium systems under an inert cover gas, until late 1995.[8] In 1996, the sodium in the facility drain tanks (approximately 103,930 pounds) was removed and transferred to a sodium supplier for reuse. In 1997, the two below-grade drain tanks and the SCTL sodium piping system were removed and cleaned.[9] By the end of 1999, the facility was demolished and the foundations, pits, and utilities were removed. A void remained

[1] Neely, H.H., *Sodium Component Test Laboratory (SCTL) System Design Description, 026-XC-0010*, Energy Technology Engineering Center, March 15, 1982 Revised September 30, 1987, pgs. 2-28, 2-91.
[2] *Santa Susana Field Laboratory Electric Meter Installation Sub Station Number 726 Building 026 and 1250 HP Motor Generator, 303-GEN-E266*, Rockwell International Corporation, June 1, 1977.
[3] Horton, P., *Appendix A, Building Reconnaissance Report, Building 026, GEN-??-0000*, September 30, 1996.
[4] *Technical Site Information Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-41, b-45.
[5] *SSFL Area IV, Bldg. 359, Water/Sewer Distribution, Demolition & Installation, M359-68339-MI*, Rockwell International, December 12, 1966, HDMSe00455082.
[6] U.S. Department of Energy, *Small Component Test Loop*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Sodium/SCTL.html, accessed November 25, 2009, p.1.
[7] Rutherford, P.D., *Site Environmental Report for Calendar Year 1998 , DOE Operations at Rocketdyne Propulsion & Power, RD99-115*, The Boeing Company, Rocketdyne Propulsion & Power, September 22, 1999, p. 2-10.
[8] U.S. Department of Energy, *Small Component Test Loop*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Sodium/SCTL.html, accessed November 25, 2009, p.1.
[9] Rutherford, P.D., *Site Environmental Report for Calendar Year 1998 , DOE Operations at Rocketdyne Propulsion & Power, RD99-115*, The Boeing Company, Rocketdyne Propulsion & Power, September 22, 1999, p. 2-10.

where the concrete pits and foundations were removed.[1] Back filling with soil was completed in 2000.[2]

Information from Interviewees: A number of former employees were interviewed about their experience at the SSFL. One remembered the LCTL. Excerpts from this interview are included below.

Interviewee 83 worked at the Santa Susana Field Laboratory from March 1957 to June 1986 starting in the fire department and ending as a shift leader at the LCTL. The following excerpts were pulled from the interview.

> *"I was in the fire department and eventually I was the fire lieutenant. I understand you are interested in what I know about materials being disposed of on-site in Area IV. We did dispose of sodium-contamination at the sodium burn pit. When we had to get rid of something that was contaminated with sodium, we'd hit it with water and it would explode. I remember one time one of the guys hit a barrel with water and it was right below some large power lines. It shot up in the air. It was amazing; it went through those lines and didn't hit anything!*
>
> *When a facility had something to dispose of, some oil or chemicals or something, they would call the fire department and ask us to pick it up. Sometime before Saturday we'd pick up the material to be disposed; disposal happened on Saturdays. Stuff that was contaminated with sodium would go to the Sodium Burn Pit. Usually that was in big containers that were used in a test loop. We'd hit it with water and it would blow. Sometimes we would have to shoot the container or barrels to puncture them, to get them to sink and let water get in there so that they could blow up. I have heard that some people would take sodium home and use it for fishing – they'd put it in water and blow the fish out. None of the firemen did that though.*
>
> *We disposed of a lot of material by the north flats near the property line. We had a regular disposal area out there. It was near the northeast corner, almost to the property line. It was just out in the open area.*
>
> *After I was a fireman, I went to work in the LCTL; it was very interesting. Our job was to take large components that would go into reactors and then test them to see if we could make them fail. That's what I did after I stopped being a firefighter. You knew that stuff would break down eventually; we wanted to see how long it would take. The company was in the business of selling reactor parts, and we wanted to make sure how long the parts we sold would last. We needed to know when and how they would fail so we could protect the company's business.*

[1] The Boeing Company, Rocketdyne, *Site Environmental Report for Calendar Year 1999 DOE Operations at The Boeing Company Rocketdyne*, *RD00-159*, September 2000, p. 2-8.
[2] The Boeing Company, Rocketdyne Propulsion & Power, *Site Environmental Report for Calendar Year 2000 DOE Operations at The Boeing Company Rocketdyne Propulsion & Power*, *RD00-152*, September 2001, p. 2-9.

> *Eventually, I ended up being a shift leader at the LCTL. We sent a lot of the materials to the same disposal areas. Somebody in the Fire Department actually did the disposal."*[1]

Radiological Incident Reports: There have been two incidents associated with Building 4026. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4026 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0465	9/10/1969	GAMMAGRAH SITE	Ir-192	EMPLOYEE DISREGARDED WARNING SIGNS AND ENTERED FIELD RADIOGRAPHIC OPERATION.
A0238	10/3/1979	SCTL	Ir-192	STUCK GAMMAGRAPH SOURCE RECOVERED.

Current Use: Demolished in 1999.[2] Based on available information, the dimensions of the excavation made during building demolition are unknown. A photograph of the Building 4026 site after demolition is shown in Figure 2.4.1d.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Prior to removal of the SCTL drain tanks in 1996, sodium in the system was tested for radiological contamination and none reportedly was detected.[3]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4026 is first identified in a 1959 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no

[1] Interview No. 83 conducted by DOE in 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, pgs. P-1–P-2.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-2.

longer present. By 2003, Building 4026 was no longer present in PA-1. In 1978 and 1980 a large stained area is located southwest of Building 4026 and outside the PA-1 area.[1]

Aerial photograph analysis from 1959 to 2005 identifies a hazardous material storage area (HMSA) located north of Building 4026 inside PA-1. In 1959, a new building (possibly Building 4357), a possible below ground/recessed area, and a possible stain were observed. The possible recessed area remained visible in 1962/63 and a possible underground storage tank was noted. These features could not be confirmed on the 1965 or 1967 photographs. By 1978, a probable open storage area was observed housing approximately six to eight objects, each about one-fourth the size of an automobile. In 1980, probable staining was observed, and in 1983 and 1987 an area of dark-toned material was visible. In 1990 and 1992, areas of possible staining were noted. By 1993, this area no longer appeared active. In 1998, approximately 12 containers, each about the size of an automobile, were observed at this location. By 2002, the containers and the building had been removed from the former HMSA.[2]

Radionuclides of Concern: The research team did not find historical evidence indicating that unsealed regulated radioactive materials were handled at the SCTL facility.[3] Evidence of iridium-192 (Ir-192) sealed source use is seen in the Incident Report described below. This suggests other sealed sources could also have been used in Building 4026. Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[4] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[5,6,7] All radionuclides of concern listed, with the exception ofMn-54 and Ir-192, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 and Ir-192 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-2.
[4] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[6] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[7] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.

Drainage in this technical memorandum.[1] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[2,3] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010, 4012, and 4024 could potentially impact Building 4026. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4026.

Radiological Contamination Potential: Class 2 because of sealed source use in Building 4026, incident, lack of site investigation, and potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.4 provide a convenient reference for the following recommendations.

Due to the radioactive sealed source use, lack of site investigation, and potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4026 area. This includes the following Building 4026 areas:

- Former sodium tank vault locations. Based on Figure 2.4.1b, these vaults may have been located in the Building 4826 footprint despite being associated with Building 4026. If radiological materials migrated or were released into the pit, residual contamination may exist in the area.

- Former catch basin area located between the Building 4026 footprint and the Building 4355 footprint. Storm water originating from Buildings 4010 or 4012 could potentially discharge into this catch basin. Consequently, the catch basin may be an area with residual contamination.

- Area of probable leakage identified in aerial photograph at northwest corner of the Building 4026 footprint. If radioactive materials were released, residual contamination may exist.

- Eastern portion of the Building 4026 footprint where radiographic exposure occurred and residual contamination may exist.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[3] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Drainage pathways associated with the Building 4026 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.4.2 Building 4226 Area

Site Description: The Building 4226 area comprises Building 4226 and the land surrounding it between 17th Street and 20th Street. Building 4226 was constructed between 1978 and 1980 as the Small Component Test Loop (SCTL) Motor Generator Building.[1,2] Buildings 4026, 4226, and 4826 together comprised the SCTL complex.[3] Figures 2.4.2a through 2.4.2c provide a current photograph and the best available building-specific drawing(s) that the research team could find. Buildings 4026 and 4826 are discussed elsewhere in this section. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4226 consisted of a concrete slab floor with a steel frame, roof, and siding. It measured 22 feet long, 27 feet wide and 12 feet high with 594 square feet of floor area.[4] Building 4226 did not contain any restrooms or heating and ventilation features.[5] Building 4226 was a 20 foot by 25 foot building that housed a motor generator unit with a 1,000 horsepower motor and an 875 kilovolt-ampere generator. A Dynamatic speed controller was also housed in the building.[6] Figure 2.4.2b presents a foundation and elevation drawing of Building 4226. Figure 2.4.2c presents more detail on the concrete case and fiberglass-lined sump associated with Building 4226.

Former Use(s): Building 4226 was identified as the SCTL Motor Generator Building and housed non-radiological hazardous materials.[7]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 1999.[8] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): At demolition and prior to offload, liquid sodium from the SCTL was tested for radioactivity and reportedly found to be free of contamination.[1]

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-5.
[3] Rutherford, P.D., *Site Environmental Report for Calendar Year 1998 , DOE Operations at Rocketdyne Propulsion & Power, RD99-115,* The Boeing Company, Rocketdyne Propulsion & Power, September 22, 1999, p. 2-10.
[4] *Appendix A, Building Reconnaissance Report, Building 226, GEN-??-0000*, November 12, 1996, pgs. 31, 34.
[5] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-35.
[6] *Appendix A, Building Reconnaissance Report, Building 226, GEN-??-0000*, November 12, 1996, pgs. 31, 34.
[7] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-5.
[8] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-5.

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4226 is first identified on a 1980 aerial photograph. It is located northeast of an area identified as having a probable stain in 1978. Building 4226 is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. Aerial photographs from 1980 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4226 was no longer present in PA-1.[2]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4226.[3] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, and U-234, U-235, U-238.[4,5,6] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[7] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[8,1] Because the general slope of Area IV is in a

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. P-5.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] *Appendix A, Building Reconnaissance Report, Building 226, GEN-??-0000,* November 12, 1996, pgs. 31, 34.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[5] Unknown Author, *Facility Information, Building 012,* Unknown Date, HDMSP001828011.
[6] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790,* Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, pgs. 5, 10.
[7] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[8] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.

southerly direction, runoff containing residual contamination from the former SNAP Buildings 4010 and 4012 could potentially impact Building 4226. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4226.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.4 provide a convenient reference for the following recommendations.

Due to lack of site investigation, and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4226 area. This includes the following Building 4226 areas:

- Former sump that appears to be located exterior to the Building 4226 footprint to the south. If radiological materials migrated or were released into the sump, residual contamination may exist in the area.

- Stained area identified in aerial photographs south of the Building 4226 footprint. An unknown stain could be a potential source of contamination.

- Drainage pathways associated with the Building 4226 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.4.3 Building 4358 Area

Site Description: The Building 4358 area comprises Building 4358 and the land surrounding it. Building 4358 was constructed in 1967 as the Sodium Component Test Installation (SCTI) Chemical Storage Building. It was located northwest of SCTI Building 4656 at the corner of B and 20th Streets. In 1978, the building became a Small Component Test Loop (SCTL) Chemical Storage Building and was moved to a new location south of SCTL Building 4026 and west of 17th Street.[2,3,4] Because Building 4358 changed locations, it is discussed as part of Group 2 and Group 4 building areas. Figures 2.4.3a through 2.4.3b provide a current photograph and the best available building-specific drawing(s) that the research team could find. SCTL Buildings 4026, 4226, and 4826 are all discussed elsewhere in this section. No as-built drawings were located for Building 4358. Plate 1 presents a summary of all identified features for this site.

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[1] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[2] *Appendix A, Building Reconnaissance Report, Building 358, GEN-??-0000,* November 15, 1996, p. 31.
[3] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[4] Wondolleck, John, *Area IV Santa Susana Field Laboratory, Environmental Impact Statement, Draft Gap Analysis Report*, CDM, June 1, 2008, Appendix A, p. 13.

Building Features: Building 4358 was constructed with a concrete slab floor and steel frame, siding, and roof. The building measured 22 feet long, 50 feet wide, and 12 feet high with 1,120 square feet of floor area.[1] Building 4358 did not contain any restrooms, but was heated.[2] A sanitary sewer map shows a sewer line that appears to be located south of the 1978 Building 4358 location.[3] Figure 2.4.3b presents a floor plan of Building 4358.

Former Use(s): Building 4358 was originally constructed as a chemical storage facility in support of SCTI and then became a chemical storage building in support of SCTL and Kalina operations.[4]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Building 4358 was demolished in 2003.[5] Building structures were removed followed by the below-grade pipes, ducts, trenches, tanks and pits. It doesn't appear that there were any large pits associated with Building 4358. The exact dimensions of the excavation are unknown. Backfilling and grading used onsite soil from the borrow area.[6,7]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): During demolition, Building 4358 debris was surveyed daily for total and removable contamination. No radiological contamination reportedly was detected. This area was covered as part of Rockwell/Rocketdyne's 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4358. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[8]

Radiological Use Authorizations: None found.

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[1] *Appendix A, Building Reconnaissance Report, Building 358, GEN-??-0000*, November 15, 1996, p. 31.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-36.
[3] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-23.
[4] Wondolleck, John, *Area IV Santa Susana Field Laboratory, Environmental Impact Statement, Draft Gap Analysis Report*, CDM, June 1, 2008, Appendix A, p. 13.
[5] Wondolleck, John, *Area IV Santa Susana Field Laboratory, Environmental Impact Statement, Draft Gap Analysis Report*, CDM, June 1, 2008, Appendix A, p. 13.
[6] Kneff, et al., *Sodium Component Test Installation (SCTI) Demolition Final Report, EID-08336*, The Boeing Company, October 2003, p. 39.
[7] Correspondence from Lopez, J., Lopez General Engineering Contractors, Inc., to Robinson, K.S., The Boeing Company, *Reference: SCTI Demolition Buildings: 4355, 4356, 4357, 4358, 4457 & Associated, May 22, 2002*.
[8] Rockwell International, Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4358 is first identified in a 1967 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. In 1978, Building 4358 is relocated, but is still within PA-1. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. In 1988, possible saturated material was identified along the southeast side of Building 4358. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4358 was no longer present in PA-1.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4358. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium (H-3), and natural and enriched uranium (U-234, U-235, U-238).[2,3,4] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum. The 17th Street Drainage is discussed later in this section. Aerial photographs from 1965 to 2005 also show drainage flowing south from 20th Street and continuing into Area III impoundments.[5] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.
[3] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[4] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

4010 and 4012 could potentially impact Building 4358. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4358.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.4 provide a convenient reference for the following recommendations.

Due to the limited site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the 1978 Building 4358 area. This includes the following Building 4358 areas:

- Sanitary sewer south of Building 4358. If radioactive materials were released into the sewer lines, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Drainage pathways associated with the Building 4358 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.4.4 Building 4826 Area

Site Description: The Building 4826 area comprises Building 4826, Electrical Substation 4726, and the land surrounding these buildings. Building 4826, part of the Small Component Test Loop (SCTL) complex, was originally built as part of the Large Component Test Loop (LCTL) complex in 1958.[1] Buildings 4026, 4226, and 4826 together comprised the SCTL complex.[2] Building 4826 was the SCTL Test Facility located between 17th and 20th Streets. It was serviced by Electrical Substation 4726.[3,4] Figures 2.4.4a through 2.4.4c provide a current photograph and the best available building-specific drawing(s) that the research team could find. No as-built drawings were located for Building 4826. Plate 1 presents a summary of all identified features for this site.

Building Features: The STCL complex was 10,340 square feet with a 9,659-square-foot laboratory and 681 square feet of non-laboratory space. The SCTL complex consisted of an enclosed component test area, a sodium transport and storage system, an instrument and control

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[1] U.S. Department of Energy, *Small Component Test Loop*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Sodium/SCTL.html, accessed November 25, 2009, p.1.
[2] Rutherford, P.D., *Site Environmental Report for Calendar Year 1998 , DOE Operations at Rocketdyne Propulsion & Power, RD99-115*, The Boeing Company, Rocketdyne Propulsion & Power, September 22, 1999, p. 2-10.
[3] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.
[4] DE-AC03-98SF21530, *Environmental Restoration and Remediation of the Former Energy Technology Engineering Center*, Contract Awarded to Boeing North American, Inc., Rocketdyne Propulsion & Power, December 31, 1998, Attachment 1, Appendix 2, pgs. 2-3.

system, and other interfacing systems. The sodium transport and storage system consists of four test loops, a thermal conditioning loop, and two liquid sodium storage/drain tanks that act as reservoirs for normal and emergency draining.[1,2,3]

Building 4826 was the SCTL Test Facility. The test facility building was steel-framed and fully enclosed. The roofing and walls are corrugated, galvanized sheet metal. The base is steel-lined concrete. Building 4826 housed the test tower, components test area, and drain tanks. The building provided weather protection for all sodium piping and vessels. The test tower was a 30 foot square by 80 foot high structure that supported the 9,500-gallon vertical core tank (T-1) containing liquid sodium and portions of the test loop. The drain tanks, housed in secondary containment pits, were located in Building 4826 and occupied an area of 16 feet by 40 feet. The pits were separated by a concrete partition, walled with steel plate, and surrounded by a curb to prevent surface water and ground level sodium spills from draining into the pits. Walls and floors were water-proofed to prevent intrusion of ground water. A sump pump was located nearby to remove any water that accumulated in the pits. The drain pits contained liquid sodium storage/drain tanks T-2 and T-3. T-2 had a capacity of approximately 9,050 gallons and T-3 had a capacity of 11,500 gallons. The tanks were mounted horizontally on structural steel stands 12 feet below grade to allow for gravity drainage.[4] Figure 2.4.4b presents a floor plan of SCTL Buildings 4026 and 4826. The floor plan notes the two drain tank pits in Building 4826. Figure 2.4.4c is a 1996 photograph showing the drain tanks and pits.

Former Use(s): The SCTL was originally built as the LCTL and operations began in 1959 with a pump test.[5] This facility was used to test small components such as valves and pumps in liquid sodium.[6] The SCTL's principal purpose was to provide a test bed for non-nuclear qualification testing of typical liquid metal fast breeder reactor components and to obtain test data for verification of the elevated temperature design criteria of the piping design guide. In 1970, the LCTL was modified, expanded, and re-designated as the SCTL. In 1974, the facility was again modified and expanded. In 1978 a new control room was added onto the northwest corner of the facility, giving the complex its final appearance. Testing within the facility continued periodically from 1959 until 1985. Upon completion of the test programs, the sodium was drained into the facility sodium drain tanks and all systems were secured. The facility was maintained in inactive standby status, with the sodium systems under an inert cover gas, until late 1995.[7] In 1996, the sodium in the facility drain tanks (approximately 103,930 pounds) was removed and transferred to a sodium supplier for reuse. In 1997, the two below-grade drain

[1] Cleveland, J.R., Safety Hazards Report, GEN-ZR-0001, Energy Technology Engineering Center, April 30, 1985, pg. 38.
[2] U.S. Department of Energy, *Small Component Test Loop*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Sodium/SCTL.html, accessed November 25, 2009, p.1.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-1.
[4] Neely, H.H., Sodium Component Test Laboratory (SCTL) System Design Description, 026-XC-0010, Energy Technology Engineering Center, March 15, 1982 Revised September 30, 1987, pgs. 1-8, 2-6, 2-28, 2-30, 2-70–2-72.
[5] U.S. Department of Energy, *Small Component Test Loop*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Sodium/SCTL.html, accessed November 25, 2009, p.1.
[6] Rutherford, P.D., *Site Environmental Report for Calendar Year 1998 , DOE Operations at Rocketdyne Propulsion & Power, RD99-115*, The Boeing Company, Rocketdyne Propulsion & Power, September 22, 1999, p. 2-10.
[7] U.S. Department of Energy, *Small Component Test Loop*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Sodium/SCTL.html, accessed November 25, 2009, p.1.

tanks and the SCTL sodium piping system were removed and cleaned.[1] By the end of 1999, the facility was demolished and the foundations, pits, and utilities were removed. A void remained where the concrete pits and foundations were removed.[2] Back filling with soil was completed in 2000.[3]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 1998.[4] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Results of a building reconnaissance report conducted in July 1996 reportedly found the building to be free of radiological contamination. Prior to removal of the SCTL drain tanks in 1996, sodium in the system was tested for radiological contamination and none reportedly was detected.[5]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Structures are located in the vicinity of Building 4826 on aerial photographs as early as 1959, but it is difficult to separate Building 4826 from Building 4026 given the continual growth of the SCTL complex over the years. Building 4826 is included in a processing area designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. In 1980 and 1983, a possible stain was noted in PA-1. A probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. By 2005, Building 4026 was no longer present in PA-1.[6]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4826. Radionuclides associated with potential migration from Building 4006

[1] Rutherford, P.D., *Site Environmental Report for Calendar Year 1998 , DOE Operations at Rocketdyne Propulsion & Power, RD99-115*, The Boeing Company, Rocketdyne Propulsion & Power, September 22, 1999, p. 2-10.
[2] The Boeing Company, Rocketdyne, *Site Environmental Report for Calendar Year 1999 DOE Operations at The Boeing Company Rocketdyne, RD00-159*, September 2000, p. 2-8.
[3] The Boeing Company, Rocketdyne Propulsion & Power, *Site Environmental Report for Calendar Year 2000 DOE Operations at The Boeing Company Rocketdyne Propulsion & Power, RD00-152*, September 2001, p. 2-9.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-51.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-51.
[6] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[1] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[2,3,4] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[5] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from Sodium Laboratory Building 4006 and the SNAP Buildings 4010 and 4012 could potentially impact Building 4826. Building 4006 had minor use of radioactive material. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4826.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.4 provide a convenient reference for the following recommendations.

Due to the limited site investigation and potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012, there is a possibility that

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[1] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[3] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[4] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4826 area. This includes the following Building 4826 areas:

- Former drain pits located in the Building 4826 footprint. If radiological materials migrated or were released into the drain pits, residual contamination may exist in the area.

- Drainage pathways associated with the Building 4826 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.5 Group 5

The Group 5 index map is presented in Figure 2.5. Following Figure 2.5, the site photograph and layout drawings for each building area within HSA-5B Group 5 are presented. HSA-5B Group 5 includes two building areas containing the Kalina Complex buildings. The Kalina Complex is comprised of Buildings 4334 and 4335.

2.5.1 Building 4334 Area

Site Description: The Building 4334 area comprises Building 4334 and the land surrounding it east of 20th Street. Building 4334 was constructed in 1991 as part of the Kalina Cycle Demonstration Power Plant.[1] Building 4334 was the Kalina Control Room and Office Building. It was located near Kalina Turbine Generator Building 4335, which is discussed later in this section.[2] Together, Buildings 4334 and 4335 were known as the Kalina Complex. Figure 2.5.1a provides a current photograph. The research team was unable to find building-specific drawing(s). The Kalina Complex was located southwest of Small Component Test Loop Buildings 4026 and 4226. These buildings are discussed elsewhere in this section. No as-built drawings were located for Building 4334. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4334 was a 6,256-square-foot structure on a 36,000-square-foot site that also included Building 4335 and the associated tanks, piping, and pumps for the power plant.[3] Building 4334 served as a control room and office facility for the Kalina Complex.[4] Nine aboveground ammonia tanks and one lube oil tank were associated with the Kalina Complex. Secondary containment included at least three concrete pits.[5]

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[1] U.S. Department of Energy, *Environmental Assessment Kalina Cycle Demonstration Power Plan at the Energy Technology Engineering Center Santa Susana Field Laboratory*, October 1990, pgs. 2, 23.
[2] Correspondence from Ludwig, B., The Boeing Company, Environmental Protection, to Flores, J., Ventura County Air Pollution Control District, *Reference: Kalina Complex – Buildings 4334 and 4335 Area IV, Santa Susana Field Laboratory*, dated May 5, 2003.
[3] Correspondence from Ludwig, B., The Boeing Company, Environmental Protection, to Flores, J., Ventura County Air Pollution Control District, *Reference: Kalina Complex – Buildings 4334 and 4335 Area IV, Santa Susana Field Laboratory*, dated May 5, 2003.
[4] Correspondence from Ludwig, B., The Boeing Company, Environmental Protection, to Flores, J., Ventura County Air Pollution Control District, *Reference: Kalina Complex – Buildings 4334 and 4335 Area IV, Santa Susana Field Laboratory*, dated May 5, 2003.
[5] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B,* Rockwell International Corporation, August 1993, pgs. b-42–b43, b46–b47.

Former Use(s): The Kalina Complex was developed by Kalina Technology, Ltd., to demonstrate new technology for converting heat to electricity more efficiently than conventional Rankine steam cycle power plants. It was a private venture between Rockwell International Corporation and Kalina Technology Ltd., which later became Exergy, Inc. The major unique features of the Kalina cycle power plant were the use of an ammonia and water mixture to provide variability in the temperature boiling and condensing process, as well as the use of a distillation/condensation subsystem installed between the turbine and condenser. The Kalina Complex was operated using waste heat from the SCTI and because of this was physically connected to various SCTI systems.[1,2]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in mid- to late-2003.[3] A demolition contractor estimated 300 tons of scrap metal and 1,200 yards of concrete and other material would be removed during the Kalina Complex demolition. Approximately, 600 yards of material would be required to grade the site to match natural contours.[4] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4334 were not conducted. The Building 4334 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4334. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[5]

Radiological Use Authorizations: None found.

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[1] U.S. Department of Energy, *Environmental Assessment Kalina Cycle Demonstration Power Plan at the Energy Technology Engineering Center Santa Susana Field Laboratory*, October 1990, pgs. 1-2, 13, 23.
[2] Internal correspondence from Lafflam, S.R. to Keller, J.H., Rockwell International, *Reference: Environmental Weekly Activity Report*, December 1, 1987.
[3] Kalina Demolition Trucking Forms, July 2003 – November 2003, HDMSP00039841 – HDMSP00040025.
[4] Correspondence from Mayes, R., Standard Industries, to The Boeing Company, *Reference: Technical Proposal; Kalina Plan Demolition*, May 8, 2003.
[5] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4334 is first identified on a 1995 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. In 1995, storage tanks, overhead pipes, open storage areas, a smokestack, and a probable stain are identified in PA-1. Building 4334 is not present on a 2005 aerial photograph.[1]

Radionuclides of Concern: The Kalina Complex was not a radiological facility and no radiological controls were required for its demolition or waste disposition.[2] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Building 4019 include: americium-241 (Am-241), cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[3,4] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: The Building 4005/4006 leach field was 480 linear feet and located south of Building 4334.[5] The Kalina Complex site surface was described as a flat area with a slight slope to the south that provides for drainage.[6] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum. The 17th Street Drainage is discussed later in this section. Aerial photographs from 1965 to 2005 also show drainage flowing south from 20th Street and continuing into Area III impoundments.[7] Because Building 4334 is located near 20th Street, it is possible drainage from the building went south along 20th Street instead of 17th Street. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[8,1] It is possible that runoff from

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

[2] Alex, Gregory J. et al., *Kalina Complex Statement of Work and Building Demolition Assessment Checklist*, May 2003, p. 3.

[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.

[4] Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853462.

[5] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV Santa Susana Field Laboratory, Ventura County, California, Part 1-Current Conditions Report, Volume 1,* October 1993, pgs. 4-83, 4-87.

[6] U.S. Department of Energy*, Environmental Assessment Kalina Cycle Demonstration Power Plan at the Energy Technology Engineering Center Santa Susana Field Laboratory*, October 1990, p. 35.

[7] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

[8] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.

SNAP Building 4019 could potentially impact Building 4334. The SNAP building handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4334.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019 and the Building 4005/4006 leach field, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.5 provide a convenient reference for the following recommendations.

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019 and the Building 4005/4006 leach field, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4334 area. This includes the following Building 4334 areas:

- Southern portion of site closest to former Building 4005/4006 leach field. If radioactive materials were released into the septic system, residual contamination may exist in the materials surrounding the former leach field.

- Western portion of the Building 4334 footprint closest to 20th Street drainage. The 20th Street storm drain collects storm water from SNAP Building 4019; consequently, residual contamination may exist in the materials surrounding the 20th Street drainage.

- Former tank, pump, and secondary containment pits associated with Building 4334. Although Building 4334 was not a radiological facility, areas containing former appurtenances should be sampled to ensure there was no cross contamination or migration from radiological facilities.

- Drainage pathways associated with the Building 4334 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.5.2 Building 4335 Area

Site Description: The Building 4335 area comprises Building 4335 and the land surrounding it east of 20th Street. Building 4335 was constructed in 1991 as part of the Kalina Cycle Demonstration Power Plant.[2] Building 4335 was the Kalina Turbine Generator Building. It was located near Kalina Control Room and Office Building 4334, which is discussed earlier in this

[1] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[2] U.S. Department of Energy, *Environmental Assessment Kalina Cycle Demonstration Power Plan at the Energy Technology Engineering Center Santa Susana Field Laboratory*, October 1990, pgs. 1-2, 13, 23.

section.[1] Together, Buildings 4334 and 4335 were known as the Kalina Complex. Figure 2.5.2a provides a current photograph. The research team was unable to find building-specific drawing(s). The Kalina Complex was located southwest of Small Component Test Loop Buildings 4026 and 4226. These buildings are discussed elsewhere in this section. No as-built drawings were located for Building 4335. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4335 was a 940-square-foot structure on a 36,000-square-foot site that also included Building 4334 and the associated tanks, piping, and pumps for the power plant.[2] Building 4335 included a turbine generating structure and exhaust stack for the Kalina Complex.[3] Nine aboveground ammonia tanks and one lube oil tank were associated with the Kalina Complex. Secondary containment included at least three concrete pits.[4]

Former Use(s): The Kalina Complex was developed by Kalina Technology, Ltd., to demonstrate new technology for converting heat to electricity more efficiently than conventional Rankine steam cycle power plants. It was a private venture between Rockwell International Corporation and Kalina Technology Ltd., which later became Exergy, Inc. The major unique features of the Kalina cycle power plant were the use of an ammonia and water mixture to provide variability in the temperature boiling and condensing process, as well as the use of a distillation/condensation subsystem installed between the turbine and condenser. The Kalina Complex was operated using waste heat from the SCTI and because of this was physically connected to various SCTI systems.[5,6]

Information from Interviewees: A number of former employees were interviewed about their experience at the SSFL. One remembered Building 4335. Excerpts from this interview are included below.
Interviewee 195 started working in Area IV on the hill in 1968. The following excerpt was pulled from the interview.

> *"I also worked at the Kalina facility, an ammonia turbo-generator facility, where they used ammonia in a specialized cycle. They took the excess heat out of the SCTI's heaters and ran it over to the Kalina facility thru a turbine to produce electrical power."*[7]

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[1] Correspondence from Ludwig, B., The Boeing Company, Environmental Protection, to Flores, J., Ventura County Air Pollution Control District, *Reference: Kalina Complex – Buildings 4334 and 4335 Area IV, Santa Susana Field Laboratory*, dated May 5, 2003.
[2] Correspondence from Ludwig, B., The Boeing Company, Environmental Protection, to Flores, J., Ventura County Air Pollution Control District, *Reference: Kalina Complex – Buildings 4334 and 4335 Area IV, Santa Susana Field Laboratory*, dated May 5, 2003.
[3] Correspondence from Ludwig, B., The Boeing Company, Environmental Protection, to Flores, J., Ventura County Air Pollution Control District, *Reference: Kalina Complex – Buildings 4334 and 4335 Area IV, Santa Susana Field Laboratory*, dated May 5, 2003.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-42–b43, b46–b47.
[5] U.S. Department of Energy, *Environmental Assessment Kalina Cycle Demonstration Power Plan at the Energy Technology Engineering Center Santa Susana Field Laboratory*, October 1990, pgs. 1-2, 13, 23.
[6] Internal correspondence from Lafflam, S.R. to Keller, J.H., Rockwell International, *Reference: Environmental Weekly Activity Report*, December 1, 1987.
[7] Interview No. 195 conducted by DOE in 2010.

Radiological Incident Reports: None found.

Current Use: Demolished in mid- to late-2003.[1] A demolition contractor estimated 300 tons of scrap metal and 1,200 yards of concrete and other material would be removed during the Kalina Complex demolition. Approximately, 600 yards of material would be required to grade the site to match natural contours.[2] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4335 were not conducted. The Building 4335 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4335. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[3]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Prior to the construction of Building 4335, in 1978, a stain was identified in what was to become the northeast portion of Building 4335. Building 4335 is first identified in a 1995 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. In 1995, storage tanks, overhead pipes, open storage areas, a smokestack, and a probable stain are identified in PA-1. Building 4335 is not present on a 2005 aerial photograph.[4]

[1] Kalina Demolition Trucking Forms, July 2003 – November 2003, HDMSP00039841 – HDMSP00040025.
[2] Correspondence from Mayes, R., Standard Industries, to The Boeing Company, *Reference: Technical Proposal; Kalina Plan Demolition*, May 8, 2003.
[3] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

Radionuclides of Concern: The Kalina Complex was not a radiological facility and no radiological controls were required for its demolition or waste disposition.[1] Radionuclides associated with potential migration from SNAP Building 4019 include: americium-241 (Am-241), cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[2,3] All radionuclides of concern listedare included for analysis in the August 2009 Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: The Kalina Complex site surface was described as a flat area with a slight slope to the south that provides for drainage.[4] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum. The 17th Street Drainage is discussed later in this section. Aerial photographs from 1965 to 2005 also show drainage flowing south from 20th Street and continuing into Area III impoundments.[5] Because Building 4335 is located near 20th Street, it is possible drainage from the building went south along 20th Street instead of 17th Street. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] It is possible that runoff from SNAP Building 4019 could impact Building 4335. The SNAP building handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4335.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, a stain identified in aerial photographs, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.5 provide a convenient reference for the following recommendations.

Due to the lack of site investigation, potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, and a stain identified in aerial photographs,

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[1] Alex, Gregory J. et al., *Kalina Complex Statement of Work and Building Demolition Assessment Checklist*, May 2003, p. 3.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.
[3] Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853462.
[4] U.S. Department of Energy, *Environmental Assessment Kalina Cycle Demonstration Power Plan at the Energy Technology Engineering Center Santa Susana Field Laboratory*, October 1990, p. 35.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4335 area. This includes the following Building 4335 areas:

- Western portion of the Building 4335 footprint, closet to the 20th Street drainage. The 20th Street storm drain collects storm water from SNAP Building 4019; consequently, residual contamination may exist in the materials surrounding the 20th Street drainage.

- Stain identified in aerial photograph located in northeast portion of the Building 4335 footprint. An unknown stain could be a potential source of contamination.

- Former tank, pump, and secondary containment pits associated with Building 4335. Although Building 4335 was not a radiological facility, areas containing former appurtenances should be sampled to ensure there was no cross contamination or migration from radiological facilities.

- Drainage pathways associated with the Building 4335 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.6 Group 6

The Group 6 index map is presented in Figure 2.6. Following Figure 2.6, the site photograph and layout drawings for each building area within HSA-5B Group 6 are presented. HSA-5B Group 6 includes eight building areas containing the Building 4354 Control Element Test Structure, the Building 4714 Power Pak Interconnecting Facility, the Building 4293 Time Clock 4293, the Building 4310 Portable Change Room, Parking Lot 4502, the Building 4639 Office Trailer, Electrical Substation 4704, and a Fuel Tank 4735. Group 6 contains the Building 4005/4006 leach field, which is also discussed under Group 3. Note that Building 4310, the portable change room, was moved from an area near Systems for Nuclear Auxiliary Power (SNAP) Building 4010 to support the Small Component Test Loop (SCTL). As a result, Building 4310 will be discussed as appropriate in Group 1 and Group 6 of this section.

2.6.1 Building 4293 Area

Site Description: The Building 4293 area includes Building 4293 and the land surrounding it. Building 4293 was built in approximately 1971 as a construction shack. Building 4293 was located south of SCTL Buildings 4026 and 4826 between 17th and 20th Streets. Figure 2.6.1a provides a current photograph. The research team was unable to find building-specific drawing(s). SCTL Building 4226 was not constructed until after Building 4293 was demolished. Similarly, Building 4358, an SCTL chemical storage building, was not located east of Building 4293 until after Building 4293 was demolished.[1,2] These buildings are discussed elsewhere in this section. No as-built drawings were located for Building 4293. Plate 1 presents a summary of all identified features for this site.

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-7.

Building Features: No information was located.

Former Use(s): Although designated as a construction/storage facility, Building 4293 served as a time clock station.[1]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished after June 1995.[2] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4293 were not conducted. This area was covered as part of Rockwell/Rocketdyne's 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4293. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[3]

Radiological Use Authorizations: None found.

Former Burial Radiological or Disposal Location: None found.

Aerial Photographs: Building 4293 is first identified on a 1980 aerial photograph. It is located southeast of an area identified as having a probable stain in 1978. Building 4293 is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. Building 4293 appears on a 1983 aerial photograph, but is not visible in a 1988 photograph. Aerial photographs from 1980 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978 and 1980. In 1980 and 1983, a possible stain was

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-7.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Rockwell International, Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

noted in PA-1. Building 4293 appears to be present in a 1995 aerial photograph, but not in a 2005 aerial photograph.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4293. Radionuclides associated with potential migration from former SNAP Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium isotopes (U-234, U-235, U-238).[2,3,4] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[5] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4293. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a slight possibility of radiological contamination in the area of Building 4293.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012 and limited site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[3] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790,* Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[4] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Due to limited site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4293 area, including drainage pathways associated with the Building 4293 area and outside Area IV as proposed by the field sampling plan. Residual contamination above agricultural PRCs may exist in drainages outside of Area IV.

2.6.2 Building 4310 Area

Site Description: The Building 4310 area comprises Building 4310 and the land surrounding it. Building 4310 was constructed in the early 1960s. It was a small, portable structure. Building 4310 appears near Systems for Nuclear Auxiliary Power (SNAP) Experimental Reactor Building 4010 on a January 1967 industrial planning map. It appears near Small Component Test Loop (SCTL) Buildings 4826, and Control Element Test Structure 4354 on industrial planning maps from 1971 through 1973.[1,2] Because Building 4310 changed locations, it is discussed as part of Group 1 and Group 6 building areas. Figure 2.6.2a provides a current photograph. The research team was unable to find building-specific drawing(s). Buildings 4010, 4026, 4226, 4228 and their associated structures are discussed elsewhere in this section. Building 4358 was not located west of Building 4310 until after Building 4310 had been demolished. No as-built drawings were located for Building 4310. Plate 1 presents a summary of all identified features for this site.

Building Features: A sanitary sewer map shows a sewer line that appears to be located south of Building 4310.[3]

Former Use(s): Building 4310 was identified as a portable change room on industrial planning maps.[4]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Building 4310 was demolished between March 1973 and March 1975.[5] As a portable structure, it is not clear how Building 4310 was demolished.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to the final location of Building 4310 were not conducted. The Building 4310 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-9.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-23.
[4] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[5] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4310. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: By 1972, Building 4310 was included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. In 1972, possible storage tanks were noted in PA-1. Building 4310 is not present in 1978.[2]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4310. Radionuclides associated with potential migration from SNAP Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium isotopes (U-234, U-235, U-238).[3,4,5] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street

[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[4] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[5] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.

Drainage in this technical memorandum.[1] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[2,3] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4310. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4310.

Radiological Contamination Potential: Class 2 for 1971 Building 4310 area because building was relocated from a Class 1 area, potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, and limited site investigation had been conducted.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

Due to limited site investigation, possible residual radioactive contamination from being located in a Class 1 area, and potential radioactive material migration via surface water flow or airborne release from SNAP Buildings 4010 and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the 1971 Building 4310 area. This includes the following Building 4310 areas:

- Sanitary sewer located south of the site. If radiological materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Drainage pathways associated with the Building 4310 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.6.3 Building 4354 Area

Site Description: The Building 4354 area comprises Building 4354 and the land surrounding it. Building 4354 is first identified on a 1962 industrial planning map and a 1962/63 aerial photograph. It is listed on industrial planning maps as a Control Element Test Structure. Building 4354 is located west of Sodium Laboratory Building 4006, east of Portable Change Room Building 4310, and south of Small Component Test Loop (SCTL) Buildings 4026, 4226,

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[3] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

and 4826.[1,2,3] Figure 2.6.3a provides a current photograph. The research team was unable to find building-specific drawing(s). Buildings 4026, 4226, 4310, 4358, 4714, and 4826 and their associated structures are discussed elsewhere in this section. No as-built drawings have been located for Building 4354. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4354 was 800 square feet with a steel roof, frame, and siding.[4] A sanitary sewer map shows a sewer line that appears to be located at the south of Building 4354.[5]

Former Use(s): Building 4354 is identified as the Control Element Test Structure and was part of the SCTI.[6] Building 4354 was a non-radiological facility used to test the mechanical systems by which control rods were moved in support of the Fast Breeder Reactor.[7]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in the mid-1980s.[8] A 1992 industrial planning map identifies Building 4354 as foundation only.[9] A 2005 aerial photograph indicates the foundation was removed.[10] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4354 were not conducted. The Building 4354 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4354. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume2 – Area IV Site Summaries,* May 2005, p. P-15.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume2 – Area IV Site Summaries,* May 2005, p. P-15.
[5] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B,* Rockwell International Corporation, August 1993, p. b-23.
[6] DE-AC03-98SF21530, *Environmental Restoration and Remediation of the Former Energy Technology Engineering Center*, Contract Awarded to Boeing North American, Inc., Rocketdyne Propulsion & Power, December 31, 1998, Attachment 1, Appendix 2, p. 1.
[7] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume2 – Area IV Site Summaries,* May 2005, p. P-15.
[8] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume2 – Area IV Site Summaries,* May 2005, p. P-15.
[9] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[10] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4354 is first identified in a 1962/63 aerial photograph and is included in a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. Because multiple buildings are included in PA-1, aerial photograph analysis for this area cannot be attributed to specific buildings, unless explicitly stated. A 1962/63 aerial photograph identifies overhead pipes and ground scarring in PA-1. Aerial photographs from 1965 through 1995 denote possible storage tanks and overhead pipes in PA-1. Open storage areas are noted in PA-1 in 1978, 1980, and 1995. In 1967 and 1978, a stain was identified in PA-1. A possible stain was noted in 1980 and 1983 and a probable stain was identified in PA-1 in 1995. By 1998, all of the previously identified features in PA-1 were no longer present. In 2005, not even the foundation of Building 4354 is visible in PA-1.[2]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4354. Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[3] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[4,5,6] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has

[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[5] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[6] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.

half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[1] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[2,3] Because the general slope of Area IV is in a southerly direction, runoff from SNAP Buildings 4010 and 4012 could potentially impact Building 4354. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4354.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010 and 4012, and limited site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

Due to limited site investigation and potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4354 area. This includes the following Building 4354 areas:

- Sanitary sewer located south of the Building 4354 footprint. If radiological materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Drainage pathways associated with the Building 4354 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[3] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

2.6.4 Parking Lot 4502 Area

Site Description: The Parking Lot 4502 area comprised Parking Lot 4502, Time Clock 4806, Guard Shack 4657, and the land surrounding these buildings. Aerial photographs indicate that grading for the northern portion of Parking Lot 4502 occurred in 1959. This area is visible as a parking lot in a 1962/63 aerial photograph. By 1965, the southern portion of the parking lot is completed. Parking Lot 4502 runs along F Street and 20th Street.[1] The site served as a parking lot for Building 4006 and the surrounding area.[2] It was serviced by Time Clock 4806 and Guard Shack 4657.[3] Parking Lot 4502 is located south of Kalina Building 4334 and includes Industrial Engineering Office Trailer Building 4639. Both of these buildings are discussed elsewhere in this section. Figures 2.6.4a through 2.6.4b provide a current photograph and the best available building-specific drawing(s) that the research team could find. Figure 2.6.4b is an as-built power and lighting plan for Parking Lot 4502 and Time Clock Building 4806. Plate 1 presents a summary of all identified features for this site.

Building Features: The Building 4005/4006 leach field was located in the northwest end of Parking Lot 4502. It was removed in 2001. The leach field (identified as AI-Z8) was 480 linear feet and located in Parking Lot 4502, approximately 150 feet northeast of Building 4062. Although Building 4005 handled depleted and enriched uranium for 9 months in 1966-1967, it is not likely to have impacted the Building 4005/4006 leach field as the leach field was disconnected and abandoned in 1960-1961 when the sewer treatment plant was constructed.[4,5] A sanitary sewer map shows a sewer line located parallel to 20th Street and west of Parking Lot 4502.[6]

Former Use(s): Parking Lot 4502 served as a parking lot for Building 4006.[7]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, pgs. P-49, Site Summary Group P Figure.
[4] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV Santa Susana Field Laboratory, Ventura County, California, Part 1-Current Conditions Report, Volume 1*, October 1993, p. 4-87.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-49.
[6] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-23.
[7] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-49.

Current Use: A 1995 aerial photograph indicates the southern portion of Parking Lot 4502 had been removed. By 2005, the entire parking Lot 4502 was re-vegetated.[1] Based on available information, the dimensions of the excavation made during demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Parking Lot 4502 were not conducted. The Parking Lot 4502 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the Parking Lot 4502 area. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[2]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: A 1959 aerial photograph shows a graded area that was to become the northern portion of Parking Lot 4502. By 1962/63 the northern portion of the parking lot was constructed, and in 1965 the southern portion of the parking lot had been completed. In 1978, 1980, and 1983, a pipeline is shown terminating at the eastern edge of Parking Lot 4502. This pipeline originates from Fuel Tank 4735. In 1988, instead of terminating at one point along the eastern edge of the parking lot, the pipeline continues north along the eastern edge of the parking lot terminating near the northern point of the parking lot. Also noted in 1988 is possible saturated material running along the northwest side of the parking lot. In 1995, two pipelines originating from Fuel Tank 4735 run west to Parking Lot 4502. One pipeline terminates at the eastern edge of the parking lot and one pipeline continues north along the eastern edge of the parking lot. The southern portion of the parking lot appears to be demolished. By 2005 the entire parking lot is demolished and re-vegetated.[3]

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

Radionuclides of Concern: The research team did not find evidence of radioactive material use at Parking Lot 4502. Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Building 4019 include: americium-241 (Am-241), cesium-137 (Cs-137), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), and natural and enriched uranium (U-234, U-235, U-238).[1,2] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: The Building 4005/4006 leach field was located in the northwest end of Parking Lot 4502. It was removed in 2001.[3,4] A storm drainage culvert runs parallel to 20th Street and west of Parking Lot 4502.[5] Aerial photographs from 1965 to 2005 show drainage from 20th Street continuing south into Area III impoundments.[6] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[7,8] Because the general slope of Area IV is in a southerly direction and Parking Lot 4502 is located along 20th Street, drainage from the parking lot may have traveled south along 20th Street. It is also possible that runoff from SNAP Building 4019 could potentially impact Parking Lot 4502. The building handled radioactive materials and generated radionuclides. This presents a possibility of radiological contamination in the area of Parking Lot 4502.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

Due to the lack of site investigation and potential radioactive material migration via surface water flow or airborne release from SNAP Building 4019, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume1 – Methodology*, May 2005, p. 2-9.
[2] Unknown Author, *Log Book, Building 4019, 1/20/64 to 6/3/65*, January 20, 1964, HDMSP001853462.
[3] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV Santa Susana Field Laboratory, Ventura County, California, Part 1-Current Conditions Report, Volume 1*, October 1993, pgs. 4-83, 4-87.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. P-49.
[5] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[6] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[7] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[8] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Order on Consent. Therefore, additional characterization is recommended for the Parking Lot 4502 area. This includes the following Parking Lot 4502 areas:

- Former Building 4005/4006 leach field located at northwest end of the Parking Lot 4502 footprint. If radioactive materials were released into the septic system, residual contamination may exist in the materials surrounding the former leach field.

- Western portion of the Parking Lot 4502 footprint, closet to the 20th Street drainage. The 20th Street storm drain collects storm water from SNAP Building 4019; consequently, residual contamination may exist in the materials surrounding the 20th Street drainage.

- Northern portion of the Parking Lot 4502 footprint where possible saturated material was identified in aerial photographs. If this saturated material contained any radioactive materials, residual contamination may exist in this area.

- Northeastern perimeter of the Parking Lot 4502 footprint where pipeline from Fuel Tank 4735 is noted in aerial photographs. Although the pipeline contained fuel, it could have provided drainage pathways or low lying areas that would collect migrating radiological contamination.

- Drainage pathways associated with the Parking Lot 4502 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.6.5 Building 4639 Area

Site Description: The Building 4639 Area comprises Building 4639 and the land surrounding it. Building 4639 was listed in the margin of a March 1962 industrial planning map as an Industrial Engineering Officer Trailer Complex. A July 1964 industrial planning map depicts Building 4639 as a structure located at the south end of Parking Lot 4502, near the intersection of F and 20th Streets. Figure 2.6.5a provides a current photograph. The research team was unable to find building-specific drawing(s). The building was not identified on any other industrial planning maps.[1] No as-built drawings were located for Building 4639. Plate 1 presents a summary of all identified features for this site.

Building Features: No information was located.

Former Use(s): Building 4639 was identified as an Industrial Engineering Officer Trailer Complex.[2] A 2005 historical site assessment states that Building 4639 was likely planned, but never constructed.[3]

Information from Interviewees: None to date.

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[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. Not Built-7.

Radiological Incident Reports: None found.

Current Use: Demolished.[1]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4639 were not conducted. The Building 4639 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4639. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[2]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4639 appears to be identified on a January 7, 1963 aerial photograph, but has not been identified on any other aerial photographs.[3,4]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4639. Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[5,1] All radionuclides of concern listed, with the

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1 Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

2 Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

3 *Santa Susana Area IV Aerial Photograph, January 7, 1963*, University of California Santa Barbara, accessed at http://www.dtsc-ssfl.com/files/lib_aerial_photos/aerial_photos/1963_January07.pdf.

4 Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

5 Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.

exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A short storm drainage culvert runs west from the intersection of F Street and 20th Street to the storm drainage culvert that parallels the west side of 20th Street.[2] Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[3] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[4,5]

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Building 4011, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

Due to lack of site investigation and potential radioactive material migration via surface water flow or airborne release from Building 4011, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4639 area, including the drainage pathways associated with the Building 4639 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.6.6 Building 4704 Area

Site Description: The Building 4704 area comprises Building 4704 and the land surrounding it. Building 4704 was constructed prior to March 1962 as an Electrical Substation for Edison Power. The structure was located along 17th Street, near the intersection with F Street. Building 4704 is located north of Sodium Storage Building 4007 and south of Uranium Carbide Fuel Pilot Plan Building 4005.[6] Figures 2.6.6a through 2.6.6b provide a current photograph and the best

[1] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[5] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[6] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

available building-specific drawing(s) that the research team could find. Power Pak Interconnecting Facility Building 4714 is discussed elsewhere in this section. Buildings east of 17th Street are discussed in the Subarea HSA-5A TM. Plate 1 presents a summary of all identified features for this site.

Building Features: Figure 2.6.6b presents a single-line diagram of the Building 4704 substation.

Former Use(s): Building 4704 was identified as an Electrical Substation for Edison Power.[1]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Building 4704 was scheduled for demolition in 2004, but it is still standing.[2]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4704 were not conducted. The Building 4704 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4704. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[3]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4704 is identified on a 1959 aerial photograph. In 1978, a large stained area is noted north of Building 4704 and a pipeline is identified originating from Fuel Tank 4735, discussed later in this section, and terminating along 17th Street at Building 4704. In

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. O-19.
[3] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

1983 and 1988, this pipeline is shown extending further northwest along 17th Street. Building 4704 is still present on a 2005 aerial photograph.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4704. Radionuclides associated with potential migration from Building 4005 include natural and enriched uranium (U-234, U-235, U-238).[2] Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), U-234, U-235, U-238, and uranium oxide (UO_2).[3] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010, 4012, and 4024 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[4,5,6] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A lined drainage channel is located along the northeast side of Building 4704 and runs southeast along 17th Street.[7,8] Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[9] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[10,11] Because the general slope of Area IV is in a southerly direction and drainage follows 17th Street along the east side of Building 4704, runoff from Buildings 4005, 4006, 4010, 4012, and 4024 could potentially impact Building 4704.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-11.
[3] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[5] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[6] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[7] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, p. b-25.
[8] Map located at: http://dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[9] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[10] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010*, Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[11] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

All of these buildings handled radioactive materials, which means there is a possibility of radiological contamination in the area of Building 4704.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4005, 4006, 4010, 4012, and 4024, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

Due to lack of site investigation and potential radioactive material migration via surface water flow or airborne release from Buildings 4005, 4006, 4010, 4012, and 4024, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4704 area. This includes the following Building 4704 areas:

- East side of Building 4704 along the 17th Street drainage where radioactive material may have drained from radioactive facilities to the north. Residual contamination may exist along the 17th Street drainage east of Building 4704.

- Drainage pathways associated with the Building 4704 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.6.7 Building 4714 Area

Site Description: The Building 4714 area comprises Building 4714 and the land surrounding it. Building 4714was identified on a November 1992 industrial planning map as the Power Pak Interconnecting Facility. Earlier industrial planning maps identify a Building 4714 used as a research and development shop associated with the Sodium Reactor Experiment complex. It is thought that the 4714 designation was used for two separate buildings, as opposed to one building that moved. Building 4714 was located west of Cooling Tower 4616 and south of Control Element Test Building 4354.[1,2] Figure 2.6.7a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4714. Plate 1 presents a summary of all identified features for this site.

Building Features: No information was located.

Former Use(s): Building 4714 was identified on a November 1992 industrial planning map as the Power Pak Interconnecting Facility.[3] The "other" Building 4714, used for research and development at the SRE complex will be discussed in the HSA-6 TM.

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[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. G-73.
[3] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: The foundation appears in a 2005 aerial photograph.[1] The foundation has since been removed. Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4714 were not conducted. The Building 4714 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4714. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[2]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4714 is identified in a 1995 aerial photograph just south of a processing area (PA) designated PA-1 in the Environmental Protection Agency's aerial photograph analysis. In 1995, PA-1 contains storage tanks, overhead pipes, an open storage area, and a probable stain. Building 4714 was also located west of a dirt road that ran to 17th Street and had been noted as a drainage pathway in a previous aerial photograph. The foundation of Building 4714 appears to be visible in a 2005 aerial photograph.[3]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4714. Radionuclides associated with potential migration from Building 4006 include: cesium-137 (Cs-137), manganese-54 (Mn-54), tritiated titanium (H-3), natural and

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Rockwell International, Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

enriched uranium (U-234, U-235, U-238), and uranium oxide (UO_2).[1] Radionuclides associated with potential migration from Systems for Nuclear Auxiliary Power (SNAP) Buildings 4010 and 4012 include: antimony-125 (Sb-125), americium-241 (Am-241), Cs-134, Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), H-3, U-234, U-235, and U-238.[2,3,4] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum. The 17th Street Drainage is discussed later in this section. A dirt road located east of Building 4714 was shown to be a drainage pathway at one time.[5] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Because the general slope of Area IV is in a southerly direction, runoff from Sodium Laboratory Building 4006 and SNAP Buildings 4010 and 4012 could have impacted the Building 4714 area. Building 4006 handled radioactive materials. The SNAP buildings handled radioactive materials and generated radionuclides, which means there is a possibility of radiological contamination in the area of Building 4714.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010 and 4012, and limited site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

Due to limited site investigation and potential radioactive material migration via surface water flow or airborne release from Buildings 4006, 4010, and 4012, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010

[1] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, p. 2-9.
[3] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790,* Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, p. 5.
[4] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4714 area, including the drainage pathways associated with the Building 4714 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.6.8 Fuel Tank 4735 Area

Site Description: The Fuel Tank 4735 area comprises Fuel Tank 4735 and the land surrounding it. The area was fenced. Fuel Tank 4735 was constructed in 1977. Fuel Tank 4735 was located north of Building 4011 and F Street, and west of a rock outcropping.[1,2,3] Figure 2.6.8a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Fuel Tank 4735. Plate 1 presents a summary of all identified features for this site.

Building Features: Fuel Tank 4735 was 26 feet in diameter and 24 feet tall with a capacity of 86,000 gallons. It was an aboveground, vented tank constructed of carbon steel. A pump station was adjacent to Fuel Tank 4735 and it contained a concrete pad with two pumps.[4]

Former Use(s): Fuel Tank 4735 stored fuel that was pumped by the pump station to the Sodium Component Test Installation facility. Building 4320, the Fuel Oil Pump Building, filled the tank from the Fuel Tank Farm. Carbon steel piping connected the facilities. Bulk oil was removed in 1990 and Fuel Tank 4735 was cleaned in 1991.[5]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Fuel Tank 4735 was demolished with the Fuel Tank Farm in 1999. Based on available information, the dimensions of the excavation made during building demolition are unknown.[6]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Fuel Tank 4735 were not conducted. The Fuel Tank 4735 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Fuel Tank 4735. Only areas showing elevated gamma activity in the walkabout survey were followed up

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-19.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-19.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-19.
[6] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-19.

with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Fuel Tank 4735 is identified in a 1978 aerial photograph. Two pipelines are identified originating at the fuel tank. One pipeline terminates west near Parking Lot 4502 and the other pipeline travels northeast along F Street before turning northwest up 17th Street ending at Building 4704. In 1983, the pipeline along 17th Street extended further north to the south side of Building 4006. In 1988, the pipeline near Parking Lot 4502 is extended further north along the edge of the parking lot and terminates at the northern end of Parking Lot 4502. In 1995, another vertical tank appears to be located next to Fuel Tank 4735. Fuel Tank 4735 appears to have two pipeline originating from it and running west to Parking Lot 4502, while the pipeline running east to 17th Street appears to originate at the other vertical tank. A tank is still visible in a 2005 aerial photograph, but it does not appear to be Fuel Tank 4735. No pipelines are visible in 2005.[2]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Fuel Tank 4735. Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[3,4] All radionuclides of concern listed, with the exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-

[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[4] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.

182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III. Aerial photographs from 1957 to 2005 indicate that drainage from PA-1 followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum. The 17th Street Drainage is discussed later in this section.[1] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[2,3]

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Building 4011, and limited site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.6 provide a convenient reference for the following recommendations.

Due to limited site investigation and potential radioactive material migration via surface water flow or airborne release from Building 4011, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Fuel Tank 4735 area. This includes the following Fuel Tank 4735 areas:

- Pipelines located east and west of the Fuel Tank 4735 site footprint. Although the pipeline contained fuel, it could have provided drainage pathways or low lying areas that would collect migrating radiological contamination.

- Drainage pathways associated with the Fuel Tank 4735 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.7 Group 7

The Group 7 index map is presented in Figure 2.7. Following Figure 2.7, the site photograph and layout drawings for each building area within HSA-5B Group 7 are presented. HSA-5B Group 7 includes nine building areas containing the Building 4007 Sodium Storage Building, the Building 4008 Flammable Materials Storage Building, the Building 4011 Radiation Instrument

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[3] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Control Laboratory, X-Ray Buildings 4171 and 4172, the Building 4500 Gas Bottle Dock, Parking Lot 4521, the Building 4611 Paint Spray Booth Canopy, and Maintenance Building 4612.

2.7.1 Building 4007 Area

Site Description: The Building 4007 area comprises Building 4007 and the land surrounding the building located at the corner of F Street and 17th Street. Building 4007 was constructed in 1958 as the Sodium Storage Building.[1,2] Figures 2.7.1a through 2.7.1b provide a current photograph and the best available building-specific drawing(s) that the research team could find. Figure 2.7.1b is an as-built paving and grading plan for Building 4007. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4007 was a 1,500-square-foot concrete structure with a steel roof. There were no restrooms associated with Building 4007.[3] Presumably, this indicates no sewer connections or septic systems are associated with Building 4007.[4] Five aboveground tanks were associated with Building 4007, including two 60-gallon diesel tanks, and three 600-gallon tanks of unknown contents.[5] The locations of these tanks are currently unknown.

Former Use(s): Building 4007 was identified as a sodium storage building and used for storage of non-radiological hazardous materials.[6]

Information from Interviewee(s): None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 1996.[7] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4007 were not conducted. The Building 4007 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4007. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. Q-1.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. Q-1.
[4] *B0008 Warehouse* Notes, Unknown Author, February 11, 2000, HDMSP001786349.
[5] Correspondence from Tessier, M., Rockwell International, to LeChevalier, R., United States Department of Energy, *Reference: Storage Tanks at DOE Facilities in SSFL Area IV*, dated December 23, 1992.
[6] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. Q-1.
[7] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. Q-1.

survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Locations: None found.

Aerial Photographs: Building 4007 is first identified on a 1959 aerial photograph. In 1967, a pipeline begins just north of Building 4007 on 17th Street and continues southeast to G Street where the pipeline turns and runs southwest on G Street to Building 4500. In 1978, a pipeline is noted to the north of Building 4007 along F Street. The pipeline extends from Building 4008 to 17th Street. This pipeline is not noted in any other aerial photographs. Building 4007 is not present on a 2005 aerial photograph.[2]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4007. Radionuclides associated with potential migration from Buildings 4005, 4006, 4010, 4012, and 4024 that may affect Building 4007 include: antimony-125 (Sb-125), americium-241 (Am-241), cesium isotopes (Cs-134, Cs-137) cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), manganese-54 (Mn-54), isotopes of plutonium (Pu-238, Pu-239, Pu-240, Pu-241), strontium-90 (Sr-90), tritiated titanium (H-3), and natural and enriched uranium (U-234, U-235, U-238). [3,4,5,6] All radionuclides of concern listed, with the exception of Mn-54, are included for analysis in the August 2009 Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory. Mn-54 has a half-life of less than one year and thus does not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A lined drainage channel following 17th Street to the southeast is located on the east side of Building 4007.[7] Aerial photographs from 1957 to 2005 indicate that drainage

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[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 1 –Methodology*, May 2005, pgs. 2-6, 2-9, 2-11.
[4] Cabrera Services, *Final Radiological Final Status Survey of Building 4006*, June 2008, pgs. vi, 8-9, 38.
[5] Unknown Author, *Facility Information, Building 012*, Unknown Date, HDMSP001828011.
[6] Zwetzig, G.B., *Survey of Fission- and Corrosion-Product Activity in Sodium- or NaK-Cooled Reactors, AI-AEC-MEMO-12790*, Atomics International, a Division of North American Rockwell Corporation, February 28, 1969, pgs. 5, 10.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

followed 17th Street to the south and continued to an impoundment in Area IV. This impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[1] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[2,3] Because the general slope of Area IV is in a southerly direction and drainage follows 17th Street along the east side of Building 4007, runoff from Buildings 4005, 4006, 4010, 4012, and 4024 could potentially impact Building 4007. Buildings 4005 and 4006 handled radioactive materials. Buildings 4010, 4012, and 4024 are Systems for Nuclear Auxiliary Power buildings that handled radioactive materials and generated radionuclides. Drainage from these buildings results in the possibility of radiological contamination in the area of Building 4007.

Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Buildings 4005, 4006, 4010, 4012, and 4024, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Due to lack of site investigation and potential radioactive material migration via surface water flow or airborne release from Buildings 4005, 4006, 4010, 4012, and 4024, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4007 area. This including the following Building 4007 areas:

- East side of Building 4007 footprint along the 17th Street drainage where radioactive material may have drained from radioactive facilities to the north. Residual contamination may exist along the 17th Street drainage east of Building 4007.

- Drainage pathways associated with the Building 4007 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[3] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

2.7.2 Building 4008 Area

Site Description: The Building 4008 area comprises Building 4008 and the land surrounding the building located on F Street between Building 4007 and Parking Lot 4521. Building 4008 was constructed in 1958 as the Flammable Material Storage Building.[1,2] Figures 2.7.2a through 2.7.2b provide a current photograph and the best available building-specific drawing(s) that the research team could find. Figure 2.7.2b is an as-built paving and grading plan for Building 4008. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4008 was a 1,500-square-foot concrete structure with a steel roof.[3] A leach field associated with Building 4008 was identified as an area of concern in a 1993 Current Conditions Report and Draft Resource Conservation and Recovery Act Facility Investigation (RFI) Work Plan, but no drawings or other references have been found to further describe the potential leach field. Building and field investigation has also failed to locate a leach field.[4] A 2000 RFI site review and notes on Building 4008 indicate there were no leach fields, septic tanks, or even restroom facilities associated with Building 4008.[5,6] Exploratory trench logs in the area of Building 4008 note that all surfaces were composed of disturbed soil. This disturbed soil could indicate a former leach field excavation.[7]

Former Use(s): Building 4008 was used for storage of non-radiological flammable materials.[8]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 1996.[9] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4008 were not conducted. The Building 4008 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4008. Only areas

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. Q-3.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962-November 1992.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. Q-3.
[4] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV Santa Susana Field Laboratory, Ventura County, California, Part 1-Current Conditions Report, Volume 1,* October 1993, pgs. 4-82, 4-85–4-88.
[5] *RFI Site Review Status, Leach Field Area IV B008 Warehouse*, Unknown Author, February 16, 2000, HDMSE00506904.
[6] *B008 Warehouse* Notes, Unknown Author, February 11, 2000, HDMSP001786349.
[7] Stewart, B., *Trench Logs B8TS01-06 at B008*, MWH, April 4, 2001.
[8] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. Q-3.
[9] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. Q-3.

showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[1]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Locations: None found.

Aerial Photographs: Building 4008 is first identified on a 1959 aerial photograph. In 1959, two stains are located south of Building 4008. In 1967, a pipeline is noted along G Street, south of Building 4008. A 1978 aerial photograph shows a pipeline to the north of Building 4008 along F Street. The pipeline extends from Building 4008 to 17th Street. This pipeline is not noted in any other aerial photographs. In 1980 and 1983, an open storage area is noted south of Building 4008. By 1995, this open storage area is designated OS-20 and contains a stain and probable refuse containers. Building 4008 is not present on a 2005 aerial photograph.[2]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4008. Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[3,4] All radionuclides of concern listed, with the exception of Ir-192, Mn-54, and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192, Mn-54, and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

[1] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[4] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.

Drainage Pathways: A leach field associated with Building 4008 was identified as an area of concern in a 1993 Current Conditions Report and Draft RFI Work Plan and exploratory trench logs previously indicated disturbed soil in the area of Building 4008, but no information has been found to further describe the potential leach field and field investigation has failed to locate a leach field.[1,2] A lined drainage channel following G Street is located south of Building 4008.[3] Aerial photographs from 1957 to 2005 indicate that drainage followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum.[4] The 17th Street Drainage is discussed later in this section. The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[5,6]

Radiological Contamination Potential: Class 2 due to potential radioactive material migration via surface water flow or airborne release from Building 4011, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Due to lack of site investigation and potential radioactive material migration via surface water flow or airborne release from Building 4011, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4008 area. This includes the following Building 4008 areas:

- Stains identified in aerial photographs south of the Building 4008 footprint. Unknown stained areas could contain residual contamination.

- Lined drainage channel south of the Building 4008 footprint along G Street. The G Street storm drain collects storm water from 17th Street, which in turn collects storm water from buildings using radioactive material; consequently, residual contamination may exist in the G Street drainage.

[1] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV Santa Susana Field Laboratory, Ventura County, California, Part 1-Current Conditions Report, Volume 1*, October 1993, pgs. 4-82, 4-85, 4-88.
[2] Stewart, B., *Trench Logs B8TS01-06 at B008*, MWH, April 4, 2001.
[3] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Possible leach field associated with Building 4008 using previous exploratory trench locations as a guide. If radioactive materials were released into a septic system, residual contamination may exist in the materials surrounding the former leach field.

- Drainage pathways associated with the Building 4008 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.7.3 Building 4011 Area

Site Description: The Building 4011 area comprises Building 4011, Traffic Dispatch Building 4403, Electrical Substation 4711, and the land surrounding these sites located between F and G Streets. Building 4011 was constructed in 1958 as an administration and services building, but later became the Radiation Instrument Calibration Laboratory.[1,2] Figures 2.7.3a through 2.7.3f provide a current photograph and the best available building-specific drawing(s) that the research team could find. Building 4011 is located west of Flammable Material Storage Building 4008 and east of X-Ray Buildings 4171 and 4172. These buildings are discussed elsewhere in this section. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4011 is a 15,120-square-foot steel structure.[3] Figure 2.7.3b provides a floor plan. Two aboveground tanks were associated with Building 4011, a 200-gallon propane tank and an 87,000-gallon empty tank.[4] The Building 4011 leach field (identified as AI-Z9) was 200 linear feet and received waste from a septic tank with a 2,340-gallon capacity. It consisted of 8-inch diameter clay piping surrounded by gravel and buried at depths ranging from 2 to 7 feet below ground surface. The leach field was located approximately 100 feet south of Building 4011, across G Street. It was removed in 2000.[5,6] Trench logs from 2001 indicate that the Building 4011 leach field was filled with non-native material and showed an area of staining.[7] A gas shutoff was located at the northwest corner of Building 4011 and the domestic water shutoff was at the south side of the building.[8] A sanitary sewer line is identified at the west side of Building 4011.[9] Photographs of the Building 4011 septic tank area and leach field are included as Figures 2.7.3c and 2.7.3d. Figure 2.7.3e is a 1957 as-built drawing showing the

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-1.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-1.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-41, b-45.
[5] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume IV – RFI Site Reports, Appendix D, Boeing Area IV Leach Field*, CH2M Hill, Draft in Progress November 2008, p. Table D.2-4.
[6] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV Santa Susana Field Laboratory, Ventura County, California, Part 1-Current Conditions Report, Volume 1*, October 1993, pgs. 4-84, 4-87.
[7] Stewart, B., *Trench Logs L2TS02 and L2TS03*, MWH, May 4, 2001.
[8] *Fire Preplan Area IV, Building 011 and Surrounding Area (Including Bldg. 171 and 172),* Unknown Author, Unknown Date.
[9] *Santa Susana Field Laboratory Site Development Plan, Existing Development, Sanitary Sewage System*, Rockwell International Corporation, Unknown date, HDMSE00688360.

plumbing plan for Building 4011. Figure 2.7.3f is a 1969 as-built drawing that illustrates the Building 4011 machining/milling area, cage room, tool crib, material storage area, weld area, rotary table, and Room 120 where radiological contaminated sludge was found in a sink trap (see Radiological Incident Reports below).

Former Use(s): Building 4011 was used to support various non-nuclear programs until 1984. From 1984 to 1996, the north section of Building 4011 was used for calibration and repair of radiation detection instruments. Calibration and repair could have involved instruments containing radioactive contaminants from any of the Area IV nuclear facilities. Service work used only sealed radioactive sources and electroplated calibration sources. After 1996, laboratory activities were transferred to Building 4100. The Property Inventory and Control Department used the south section of the building. The south side of Building 4011 was used as a materials warehouse for non-radiological materials.[1,2,3] Industrial planning maps indicate that Building 4011 was an administration and services building in the late 1960s and early 1970s, a development support shop in the mid-1970s, a manufacturing support shop in the late 1970s and early 1980s, a machine shop in the mid to late 1980s, and a storage facility in the early 1990s.[4]

Information from Interviewees: None to date.

Radiological Incident Reports: There have been several incidents associated with Building 4011. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

[1] U.S. Department of Energy, *Instrument Calibration Lab*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Major-Operations/Support-Ops/Instrument-Calibration.html, accessed November 25, 2009, p.1.
[2] Rash, M., *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-011, T-019, T-055, and T-100*, Tetra Tech EM, Inc., December 20, 2002, p. 9.
[3] Correspondence from Tuttle, R.J., Rockwell International, to Vaille, R., U.S. Environmental Protection Agency, *Reference: Identification and Description of Areas Involved with Radioactive Materials at SSFL Area IV*, dated October 2, 1989.
[4] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

Building 4011 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0531	4/26/1960	WEST OF BLDG 11	MFP	LEAK TEST OF OMRE SHIPPING CASK SPILLED R/A LIQUID ON GROUND.
A0519	7/14/1964	SS 19TH & F ST		EMPTY BUT LABELED R/A SHIPPING CONTAINERS FOUND IN PRIVATE CAR.
A0083	7/2/1980	RIHL, 011	Ta-182	UNEXPLAINED EXPOSURE OVER GUIDELINES.
A0318	4/13/1985	CALIBRATOR	Cs-137	CALIBRATION SOURCE CAME LOSE FROM ACUTATOR ROD.
A0651	1/6/1994	INST. CALB. LAB		INTERNALLY CONTAMINATED AIR SAMPLING PUMPS NOT LABLED.
A0658	12/6/1994	T011 CALIB. LAB	Cs-137	28 Ci Cs-137 CALIBRATION SOURCE DISLOCATED FROM RELEASE PULL ROD.

- On April 28, 1960, during the final leak test of the Organic Moderated Reactor Experiment trailer cask cooling system, a union between the two circulating lines was not tightened. When the pump was turned on, water ran out from the system onto the trailer bed and blacktop through bolt holes where the cask was secured. The water was soaked up immediately and confined to an area of about 1 square foot. Approximately 1 pint of radioactive liquid containing mixed fission products was spilled on the ground to the west of Building 4011. All loose dirt was cleaned up and a sample of the blacktop was taken. Results showed 216 disintegrations per minute beta gamma. The incident report notes that this type of operation should have been done in an area that had the proper facilities for handling contaminated equipment (A531).[1]

In addition to the incidents noted in Boeing's incident database, two other incidents pertaining to Building 4011 were identified by the research team.

- Sludge in a sink trap in Room 120 was found to contain 27.2 pCi/g of U-234. The sink and trap and a portion of the drain line were removed and disposed of as radioactive waste.[2,3,4] It is not clear from Figure 2.7.3e if the drain line was connected to the former septic tank or the sewer line, but this is a possibility.

- On January 15, 1976, a radioactive spill in the Rocketdyne conservation yard was discovered. In the search for the origin and extent of contamination, numerous radioactively contaminated barrels and pallets were recovered from a wide area of the

[1] Klostermann, J.P., *Radiological Safety Incident Report, Bldg. #11 (West Side)*, Atomics International, April 28, 1960.
[2] Barnes, J., *Final Radiological Survey Data Package for Building 011, Santa Susana Field Laboratory*, The Boeing Company, July 28, 1998.
[3] Rash, M., *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-011, T-019, T-055, and T-100*, Tetra Tech EM, Inc., December 20, 2002, p. 9.
[4] Rash, M., *Final Rocketdyne Technical Support and Field Oversight Document Review for Buildings T009, T011, T019, T055, and T100, Tetra Tech EM, Inc.*, December 20, 2002, pgs 8-9.

Santa Susana complex. A pallet in the Building 4011 receiving yard with two acetone barrels on it was discovered to be radiologically contaminated at approximately 800 millirad per hour (mrad/hr) beta. According to the incident report, all contaminated items that had been detected were transferred to the Radioactive Materials Handling Facility for disposal with the exception of three large concrete structures and a 1 mrad/hr spot on the asphalt in the Building 4011 yard. The incident report does not describe how these items were handled. Externally contaminated barrels appeared to have resulted from a double stacked barrel of radioactive liquid that corroded and leaked.[1]

Current Use: Building 4011 is still standing as of 2010 and is currently used to house communication equipment.[2]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): A chronology of radiological investigations at this building is as follows:

- **1988 Rocketdyne Field Survey**. In 1988, Rocketdyne surveyed a field south of Building 4011 and G Street because it had been used as a temporary storage or staging area for materials/equipment and was often used as a dumpsite for dirt. The field was surveyed for mixed fission products by measuring ambient gamma exposure rates. Ambient gamma exposure rates were measured at 39 locations and compared against the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.86 limit of 5 microroentgens per hour (µR/hr) above background. Natural background at the Santa Susana Field Laboratory was noted as having large variability, and for this reason, the gamma measurements were compared against three independent natural background distributions. Then the average background exposure rate of the three natural background distributions was subtracted from each data set and results were compared against the 5 µR/hr background criteria. Average background was 15.30 µR/hr. The maximum gamma exposure rate for the Building 4011 field was 13.8 µR/hr while the average for all 39 locations was 13.0 µR/hr. Survey results were below the NRC acceptable limits in 1988.[3]

- **1996 Rocketdyne Area IV Radiological Characterization**. During the 1996 Area IV Radiological Characterization Survey conducted by Rocketdyne, a randomly selected soil sample collected at the northwest corner of Building 4011 found elevated cesium-137 (Cs-137) at 0.53 picocuries per gram (pCi/g). This is above the survey's local background average of 0.09 pCi/g and Area IV background average of 0.15 pCi/g, but within the average U.S. background range of 0.8 pCi/g and the U.S. Department of Energy, U.S. Environmental Protection Agency (EPA), and U.S. Nuclear Regulatory Commission cleanup standards of 9.2 pCi/g, 9.0 pCi/g and 9.0 pCi/g, respectively. The

[1] Harris, J. and F. Badger, *Internal Letter, Conservation Yard Spill*, Rockwell International, February 6, 1976,
[2] U.S. Department of Energy, *Instrument Calibration Lab*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/Major-Operations/Support-Ops/Instrument-Calibration.html, accessed November 25, 2009, p.1.
[3] Chapman, J.A., *Radiological Survey f the T056 Landfill; Area from 23rd Street to Building T100; And An Area Across From Building T011, GEN-ZR-0011*, Rockwell International, Rocketdyne Division, August 26, 1988, pgs. 3, 9-11, 13, 20, 62, 76, 79, 81, Appendix C.

cleanup standards were based on uniform contamination and an annual dose limit of 15 millirem per year.[1]

- **1998 Rocketdyne Radiological Survey**. In 1998, Rocketdyne performed a final comprehensive radiological survey to measure total or removable surface activity on the walls, floors, ceilings, structural surfaces, concrete pads, sink traps, and the roof. The Rocketdyne acceptable release limit for fixed alpha and beta contamination was less than 5,000 disintegrations per minute per 100 square centimeters (dpm/100cm^2). The acceptable limit for removable alpha contamination was less than 20 dpm/100cm^2 and for beta it was less than 100 dpm/100cm^2. The ambient gamma release limit was less than 5.0 µR/hr above ambient background. Survey results were below the acceptable limits in 1998. Samples were collected from sludge in a sink trap for gamma spectroscopy analysis. The sludge was contaminated with low levels of uranium-234 (U-234). Results found U-234 at 27.2 pCi/g. Both the sink and trap were removed and disposed. An additional sludge sample was taken from a location several feet into the line and the sample met release criteria in 1998.[2,3]
- **1998 California DHS Verification Survey**. In 1998, the California Department of Health Services (DHS) performed verification surveys and concurred that the facility met release criteria in 1998.[4]

- **1998 Release for Unrestricted Use**. On December 16, 1998, the California DHS released Building 4011 for unrestricted use.[5]

- **2001 EPA Verification Survey**. In October 2001, the EPA conducted an oversight verification survey for alpha, beta, beta-gamma (total and removable) and gamma radiation. Survey results were below acceptable limits in 2001 and EPA field measurements confirmed the conclusions reached by Rocketdyne.[6]

Radiological Use Authorizations: Both sealed and unsealed radioactive material sources were likely handled in Building 4011.[7]

Former Radiological Burial or Disposal Locations: None found.

[1] Rutherford, P., Area IV Radiological Characterization Survey Final Report, A4CM-ZR-0011, Revision A, Energy Technology Engineering Center, August 15, 1996.
[2] Barnes, J., *Final Radiological Survey Data Package for Building 011, Santa Susana Field Laboratory*, The Boeing Company, July 28, 1998.
[3] Oliver, B.M., *Building T011 Final Survey Procedure, N001SRR140128*, Rockwell International, Rocketdyne Division, April 19, 1994.
[4] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-2.
[5] Correspondence from Wesley, D., Department of Health Services, Radiologic Health Branch, to Barnes, J., Boeing North American/Rocketdyne Division, *Reference: Building 11 Release for Unrestricted Use*, dated December 16, 1998.
[6] Rash, M., *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-011, T-019, T-055, and T-100*, Tetra Tech EM, Inc., December 20, 2002.
[7] Rash, M., *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-011, T-019, T-055, and T-100*, Tetra Tech EM, Inc., December 20, 2002, p. 9.

Aerial Photographs: Building 4011 was first identified in a 1959 aerial photograph. In 1959, an open storage (OS) area was identified at the southwest end of Building 4011 and portions of a pipeline were visible along G Street southwest of Building 4011. In 1962/63, the open storage area is identified as OS-15 and contains a stain. A probable stain is noticed in OS-15 in 1965 and a possible stain is noticed in OS-15 in 1967. In 1980 and 1983, two fill areas (FA) containing vegetated, mounded material are identified south of Building 4011 and G Street. By 1988, these two areas become part of a larger fill area identified as FA-11.[1]

Radionuclides of Concern: Both sealed and unsealed radioactive material sources were likely handled in Building 4011.[2] Radionuclides of concern include: americium-241 (Am-241), Cs-137, cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), Ta-182, technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[3,4] All radionuclides of concern listed, with the exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: The southeast side of Building 4011 parallels a lined drainage channel running along G Street.[5] The Building 4011 leach field (identified as AI-Z9) was 200 linear feet and had a septic tank capacity of 2,340 gallons. The leach field was located approximately 100 feet south of Building 4011, across G Street.[6] It was removed in 2000. Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[7] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[8,9]

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Rash, M., *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-011, T-019, T-055, and T-100*, Tetra Tech EM, Inc., December 20, 2002, p. 9.
[3] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[4] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.
[5] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[6] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV Santa Susana Field Laboratory, Ventura County, California, Part 1-Current Conditions Report, Volume 1*, October 1993, pgs. 4-84, 4-87.
[7] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[8] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[9] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Radiological Contamination Potential: Class 1 because of sealed and unsealed radioactive material sources used in Building 4011, reported incidents, and previous investigations.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the Building 4011 area. As discussed above, an incident resulted in a radioactive liquid spill to the ground and previous investigation found radiological contamination in the Building 4011 area. In addition, previous characterization studies for the Building 4011 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 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4011 area. This includes the following Building 4011 areas and appurtenances:

- Former septic tank located on the southwest side of Building 4011. 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 south of Building 4011, across G Street. If radioactive materials were released into the septic system, residual contamination may exist in the materials surrounding the former leach field.

- Sink trap locations in Building 4011 where previous radiological contamination was found. Radioactive sludge was previously found in a sink trap in the building. Residual contamination may still exist in sink traps locations or soils surrounding the sink trap locations.

- Sanitary sewer line located west of Building 4011. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Former OS-15 identified on aerial photographs west of Building 4011 where staining was noted. If radioactive materials were stored in OS-15, contamination could migrate into the Building 4011 area and residual contamination may exist west of the building.

- Northwest corner of Building 4011 where elevated Cs-137 was found in past investigations. Past cleanup efforts were not conducted to the standard of the December 2010 Administrative Order on Consent; consequently, residual contamination may exist near this corner of the building.

- Lined drainage channel south of Building 4011, along G Street. The G Street storm drain collects storm water from 17th Street, which in turn collects storm water from buildings using radioactive material; consequently, residual contamination may exist in the G Street drainage.

- Drainage pathways associated with the Building 4011 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.7.4 Building 4171 Area

Site Description: The Building 4171 area comprises Building 4171 and the land surrounding it on 19th Street between F and G Streets. Building 4171 was first identified as an X-Ray Building on a July 1964 industrial planning map. Building 4171 was built directly adjacent to Building 4612, which is discussed elsewhere in this section. Figure 2.7.4a provides a current photograph. The research team was unable to find building-specific drawing(s). Building 4171 was located west of the Building 4011 Radiation Instrument Calibration Laboratory and Electrical Substation 4711.[1,2] These buildings are discussed elsewhere in this section. No as-built drawings were located for Building 4171. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4171 was a steel-framed building with a concrete floor and measured 850 square feet.[3] A 200-gallon propane tank was located west of Building 4171, and east of 20th Street, for fueling maintenance vehicles.[4] A sanitary sewer map shows a sewer line south of Building 4171.[5] However, it is not clear if Building 4171, itself, is actually connected to this sewer line.

Former Use(s): Building 4171 was identified as an X-Ray Building on industrial planning maps.[6] It was also used for storage of radiographic sources and miscellaneous electronic equipment.[7] A 1993 Rockwell International internal letter notes that Building 4171 was a radiography room, but is currently vacant. The letter requests the use of the building to install and use a new dosimeter calibrator that contains a radioactive source. The letter states that because of relatively high levels of radioactivity, the calibrator should be placed in a separate structure away from the calibration lab in Building 4011. The dosimeter calibrator will not release radioactive materials, and thus Building 4171 will not become radioactively contaminated and will not require decontamination when use of the facility is no longer required.[8]

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[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries,* May 2005, p. R-5.
[3] *Fire Preplan Area IV, Building 011 and Surrounding Area (Including Bldg. 171 and 172),* Unknown Author, Unknown Date.
[4] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume VIII – RFI Site Reports, Appendix D, Boeing Area IV Leach Field,* CH2M Hill, Draft in Progress November 2008, p. Table D.2-2.
[5] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B,* Rockwell International Corporation, August 1993, p. b-23.
[6] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[7] Correspondence from Tuttle, R.J., Rockwell International, to Vaille, R., U.S. Environmental Protection Agency, *Reference: Identification and Description of Areas Involved with Radioactive Materials at SSFL Area IV,* dated October 2, 1989.
[8] Internal correspondence from Barnes, J., to Sitlington, S., Rockwell International Corporation, *Reference: Request of Use of SSFL Building 171,* January 6, 1993.

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in 2000.[1] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4171 were not conducted. The Building 4171 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. A walkabout gamma survey was conducted in the area of Building 4171. Only areas showing elevated gamma activity in the walkabout survey were followed up with an ambient gamma survey. Walkabout data was not reported in the characterization survey report. However, the walkabout survey results were reported to be consistent with ambient gamma survey measurements. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[2]

Radiological Use Authorizations: A safety committee annual review for 1987 notes two authorizations relating to Building 4171. Authorization 18 required leak test tags on the source safe. Authorization 42 required the door leading to the x-ray booth control room to be locked when unattended, the emergency shutdown button in the booth to be clearly posted, and leak tag tests to be updated properly.[3] No other Radiological Use Authorizations have been located.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4171 was first identified on a 1965 aerial photograph. A 1965 aerial photograph identifies a large open storage (OS) area, denoted OS-15, to the east, west, and south of Building 4171. A probable stain was noted in OS-15. In 1967, a possible stain is located south of Building 4171. In 1980 and 1983, a fill area containing vegetated, mounded material is identified south of Building 4171 and G Street. By 1988, this area is part of a larger fill area (FA) identified as FA-11. A 1995 aerial photograph identifies a probable horizontal tank west of Building 4171. By 2005, Building 4171 is no longer present.[4]

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-5.
[2] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A,* August 15, 1996.
[3] Dix, T.E., *Radiation Safety Committee Annual Review for 1987, N001SRR140105*, Rockwell International Corporation, June 15, 1988, pgs. 9, 29.
[4] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

Radionuclides of Concern: Radiographic source containers usually consisted of depleted uranium.[1] Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[2,3] All radionuclides of concern listed, with the exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Storm drainage for Building 4171 follows a culvert around the north and west of the building. The drainage flows southwest to 20th Street.[4] Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[5] Building 4171 was located north of a lined drainage channel running southwest along G Street. Two other surface drainage channels, one lined and one unlined, were located just south of G Street, between 19th and 20th Streets. These channels run south into Area III.[6] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[7,8] Building 4171 was located west of Building 4011 Radiation Instrument Calibration Laboratory, which handled radioactive materials. This presents a possibility of radiological contamination in the area of Building 4171.

Radiological Contamination Potential: Class 1 because storage of radiographic sources, potential radioactive material migration via surface waste flow or airborne release from Building 4011, and lack of site investigation.

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[1] Correspondence from Tuttle, R.J., Rockwell International, to Vaille, R., U.S. Environmental Protection Agency, *Reference: Identification and Description of Areas Involved with Radioactive Materials at SSFL Area IV,* dated October 2, 1989.
[2] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[3] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation,* April 18, 1969.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B,* Rockwell International Corporation, August 1993, p. b-25.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[7] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[8] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Due to lack of site investigation, storage of radioactive source material, and potential radioactive material migration via surface waste flow or airborne release from Building 4011, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4171 area. This includes the following Building 4171 areas:

- Former sealed source use and storage areas of Building 4171 footprint if locations can be determined. Due to lack of site investigation, areas of known radioactive material use and storage may have residual contamination.

- Sanitary sewer located south of Building 4171 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-15 identified on aerial photographs south and west of Building 4171 footprint where staining was noted. If radioactive materials were stored in OS-15, contamination could migrate into the Building 4171 area and residual contamination may exist west of the building.

- Storm drainage area along north and west of the Building 4171 footprint. The 20th Street storm drain collects storm water from Systems for Nuclear Auxiliary Power Building 4019; consequently, residual contamination may exist along the 20th Street drainage.

- Drainage pathways associated with the Building 4171 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.7.5 Building 4172 Area

Site Description: The Building 4172 area comprises Building 4172 and the land surrounding it. Building 4172 was first identified as an X-Ray Building on a March 1973 industrial planning map. The building was located adjacent to Building 4011, between 18th and 19th Streets.[1,2] Figure 2.7.5a provides a current photograph. The research team was unable to find building-specific drawing(s). Building 4011, the Radiation Instrument Calibration Laboratory, is discussed elsewhere in this section. No as-built drawings were located for Building 4172. Plate 1 presents a summary of all identified features for this site.

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-7.

Building Features: Building 4172 was a single-story building with lead/concrete block walls and a metal roof. The building measured 630 square feet.[1,2] A tank of unknown contents was associated with Building 4172 in a Resource Conservation and Recovery Act Facility Investigation (RFI) report, but no other information has been identified on this tank.[3] A sanitary sewer map shows a sewer line under Building 4172.[4]

Former Use(s): Building 4172 was identified as an X-Ray Building on industrial planning maps. It was designed for shielded room radiography of pipe welds, valves, components, and subassemblies. It was also used for storage of sealed sources that were checked every six months to ensure no leakage occurred.[5,6] Sealed plutonium fuel elements were x-ray inspected in Building 4172.[7] Reportedly, Building 4172 was mistakenly listed on a Nuclear Regulatory Commission license. The building was deleted from that license in December of 1982.[8]

Information from Interviewees: None to date.

Radiological Incident Reports: There has been one incident associated with Building 4172. The following table provides information presented in an incidents database provided by Boeing. Summaries of only the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available. Summaries of all available incident reports are provided in Attachment A.

Building 4172 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0057	4/13/1977	X RAY ROOM		MISDIRECTED X-RAY BEAM CAUSED EXPOSURE TO THE OPERATOR IN THE CONTROL ROOM.

[1] *Fire Preplan Area IV, Building 011 and Surrounding Area (Including Bldg. 171 and 172),* Unknown Author, Unknown Date.
[2] Pritchett, D., *Radiation Survey, SSFL, Building 172*, Unknown Organization, February 4, 1994, HDMSp01703040.
[3] *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume VIII – RFI Site Reports, Appendix D, Boeing Area IV Leach Field*, CH2M Hill, Draft in Progress November 2008, p. Table D.2-2.
[4] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B*, Rockwell International Corporation, August 1993, pgs. b-23.
[5] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[6] Internal correspondence from Donnelly, C.W. to Heine, W.F., Rockwell International, *Reference: Application – Authorization to Perform X-Radiography in Building 172, Nuclear Development (NDFL) Field Laboratory, Santa Susana*, dated February 25, 1974. [This supercedes similar letters dated June 4, 1973 and August 8, 1973.]
[7] Correspondence from Tuttle, R.J., Rockwell International, to Vaille, R., U.S. Environmental Protection Agency, *Reference: Identification and Description of Areas Involved with Radioactive Materials at SSFL Area IV*, dated October 2, 1989.
[8] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-7.

Current Use: Demolished in 2000.[1] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s):

- **Biannual Leak Check Program**. No leaking sealed sources reportedly were detected during the biannual leak check program. An entry in The Boeing Company's Radiation Safety Records Management System suggests that release data following decommissioning and demolition efforts at Building 4172 was collected; however, documentation of such survey has not be located to date.[2]

- **1973 Rockwell Radiation Survey**. On February 28, 1973, radiation surveys were performed at Building 4172 to determine if equipment operating limitations would be required. Four surveys were performed. Survey results ranged from less than 0.1 to 44 milliroentgens per hour (mR/hr) across all four surveys. The highest readings were recorded on the high roof of Building 4011.[3]

- **1994 Radiation Survey**. On or around February 4, 1994, a radiation survey of Building 4172 was conducted. The x-ray tube was positioned at areas to be surveyed. Survey results ranged from 0.2 to 1.5 mR/hr, but were 20 to 1,000 mR/hr when the lead shield near the cable cutout was removed. The highest readings, 1.5 mR/hr with lead shielding or 1,000 mR/hr without lead shielding, were recorded on the high roof of Building 4011.[4]

Radiological Use Authorizations: The following Use Authorizations have been located for Building 4172.

- Use Authorization Series 68, originally dated January 30, 1975, first permitted x-radiography in this building. Operations were subsequently permitted under Use Authorization Series 93, edition C, June 30, 1978. Both of these authorizations permitted the use of sealed sources for radiography.[5]

- Use Authorization 42 noted that a "Caution Radiation Area" sign was required if appropriate based on use of the building, the door leading to the x-ray booth must be locked when unattended, the emergency shutdown button in the booth must be clearly posted, and leak test tags must be properly updated.[6]

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-7.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-7.
[3] Internal correspondence from Moore, J.D., to Heine, W.F., North American Rockwell, *Reference: Radiation Survey at X-Ray Building T172*, February 28, 1973.
[4] Pritchett, D., *Radiation Survey, SSFL, Building 172*, Unknown Organization, February 4, 1994, HDMSp01703040.
[5] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-7.
[6] Dix, T.E., *Radiation Safety Committee Annual Review for 1987, N001SRR140105*, Rockwell International Corporation, June 15, 1988, pgs. 9, 29.

- Use Authorization 18 pertained to radiographic safety procedures.[1]

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4172 is first identified in a 1967 aerial photograph. In 1980 and 1983, a fill area containing vegetated, mounded material is identified south of Building 4172 and G Street. By 1988, this area is part of a larger fill area (FA) identified as FA-11. The footprint of the building is still visible in 2005.[2]

Radionuclides of Concern: Sealed sources were stored in Building 4172, but the research team did not find evidence identifying the specific sources.[3] Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[4,5] All radionuclides of concern listed, with the exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[6] Building 4172 was located north of a lined drainage channel running southwest along G Street. Two other surface drainage channels, one lined and one unlined, were located just south of G Street, between 19th and 20th Streets. These channels run south into Area III.[7] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[8,9] Building 4172 was located

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[1] Dix, T.E., *Radiation Safety Committee Annual Review for 1987, N001SRR140105*, Rockwell International Corporation, June 15, 1988, pgs. 9, 29.
[2] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-7.
[4] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[5] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.
[6] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[8] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[9] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

just west of Radiation Instrument Calibration Building 4011, which handled radioactive materials. This presents a possibility of radiological contamination in the area of Building 4172.

Radiological Contamination Potential: Class 2 because of storage of sealed sources, inspection of plutonium fuel elements, and potential radioactive material migration via surface water flow or airborne release from Building 4011.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Due to storage of sealed sources, inspection of plutonium fuel elements, and potential radioactive material migration via surface water flow or airborne release from Building 4011, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4172 area. This includes the following Building 4172 areas:

- Former sealed source use and storage areas of Building 4172 footprint if locations can be determined. Due to lack of site investigation, areas of known radioactive material use and storage may have residual contamination.

- Sanitary sewer located under Building 4172 footprint. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Drainage pathways associated with the Building 4172 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.7.6 Building 4500 Area

Site Description: The Building 4500 area comprises Building 4500 and the land surrounding it on G Street between 17th and 20th Streets. Building 4500 is identified on a March 1962 industrial planning map as a Gas Bottle Dock. The building does not appear on a 1962/63 aerial photograph, but does appear on the next available aerial photograph in 1965. Building 4500 was a small shed built on a concrete pad located south of Flammable Material Storage Building 4008 and east of Radiation Instrument Calibration Laboratory Building 4011.[1,2,3] These buildings are discussed elsewhere in this section. Figure 2.7.6a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4500. Plate 1 presents a summary of all identified features for this site.

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-11.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

Building Features: No information was located.

Former Use(s): Building 4500 was used as a storage area for portable gas containers, including argon, nitrogen, helium, and various calibration gasses. It was also a drop-off and pick-up point for suppliers. The high-pressure gas cylinders stored in Building 4500 were used throughout Area IV. In 1998, the building was identified as "foundation only" and left unused.[1]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: The walls and foundation of Building 4500 were in place as of 2005, but have since been demolished. Based on available information, the dimensions of the excavation made during building demolition are unknown.[2]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4500 were not conducted. The Building 4500 location was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4310. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[3]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4500 is first identified on a 1965 aerial photograph. In 1967, a pipeline is identified running southeast along 17th Street then turning southwest along G Street and ending just south of Building 4500. In 1972, a ground scar is located south of Building 4500 and G Street. The pipeline and ground scar are both identified in 1978 and 1980 aerial photographs. In 1980, an open storage area is also noted northwest of Building 4500. A 1983 aerial photograph identifies the pipeline, ground scar, and open storage (OS) area. In 1995, the pipeline and open storage area, now identified as OS-20, are still present. A stain and probable

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-11.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-11.
[3] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

refuse container are identified in the open storage area northwest of Building 4500. The building appears to be demolished in a 2005 aerial photograph.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4500. Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[2,3] All radionuclides of concern listed, with the exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: The southeast side of Building 4500 parallels a lined drainage channel running southwest along G Street.[4] Aerial photographs from 1957 to 2005 indicate that drainage followed 17th Street to the south and continued to impoundments in Areas III and IV. The Area IV impoundment is identified as IM-5 on aerial photograph analysis and as the 17th Street Drainage in this technical memorandum. The 17th Street Drainage is discussed later in this section. Aerial photographs from 1965 to 2005 also identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[5] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Building 4500 may have received drainage from 17th Street that was redirected along G Street to 20th Street. Drainage from 17th Street could have included runoff from Buildings 4005, 4006, 4010, 4012, and 4024, all of which handled radioactive materials. This presents a possibility of radiological contamination in the area of Building 4500.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Building 4011, stains and OS-20 identified on aerial photographs, potential radioactive drainage along G Street, and lack of site investigation.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[3] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Due to lack of site investigation, potential radioactive material migration via surface water flow or airborne release from Building 4011, stains and OS-20 identified in aerial photographs, and potential radioactive drainage along G Street, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4500 area. This includes the following Building 4500 areas:

- Stains and OS-20 identified in aerial photographs north of the Building 4500 footprint. Unknown stained areas and open storage areas could be a potential source of residual contamination.

- Ground scar identified in aerial photographs located south of Building 4500 footprint and G Street. Unknown scar should be further investigated to determine if there is any residual contamination present.

- Southeast edge of the Building 4500 footprint, near the G Street drainage channel. The G Street storm drain collects storm water from 17th Street, which in turn collects storm water from buildings using radioactive material; consequently, residual contamination may exist along the G Street drainage.

- Drainage pathways associated with the Building 4171 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.7.7 Parking Lot 4521

Site Description: The Parking Lot 4521 area comprises Parking Lot 4521 and the land surrounding it. Parking Lot 4521 is identified on a March 1962 industrial planning map as a parking lot serving Building 4011, but it is not identified on any subsequent planning maps.[1] A 2005 historical site assessment places the parking lot on the northeast and southwest sides of Building 4011, between F and G Streets and 18th and 20th Streets.[2] Aerial photographs from 1959 to 2005 indicate paved areas on either side of Building 4011, but it is not clear if the paved areas were ever used as parking lots.[3] Figure 2.7.7a provides a current photograph. The research team was unable to find building-specific drawing(s). Building 4011 is discussed elsewhere in

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, pgs. R-13 and Site Summary Group R Figure.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

this section. No as-built drawings were located for Parking Lot 4521. Plate 1 presents a summary of all identified features for this site.

Building Features: A sanitary sewer line is identified originating from the west side of Building 4011 and running west across Parking Lot 4521 to 20th Street.[1]

Former Use(s): Parking Lot 4521 served as a parking lot for Building 4011 and the surrounding area.[2]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Demolished in the mid-1960s.[3] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Parking Lot 4521 were not conducted. The Parking Lot 4521 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4310. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[4]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Aerial photographs from 1959 to 2005 indicate paved areas on the northeast and southwest sides of Building 4011, but it is not clear if the paved areas were ever used as parking lots. In 1959, the southwest paved area is identified as an open storage (OS) area. In 1962/63, the open storage area is identified as OS-15 and contains a stain. A probable stain is noticed in OS-15 in 1965 and a possible stain is noticed in OS-15 in 1967. In 1980 and

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[1] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B,* Rockwell International Corporation, August 1993, p. b-23.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-13.
[4] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.

1983, an open storage area is noted in the paved area on the northeast side of Building 4011. Additionally, two fill areas containing vegetated, mounded material are identified south of the Building 4011 paved areas and G Street. By 1988, the two areas of mounded material are identified as one large vegetated fill area (FA), FA-11. A 1995 aerial photograph notes an open storage area identified as OS-20 with a stain and probable refuse container in the paved area on the northeast side of Building 4011. In 2005, the paved areas northeast and southwest of Building 4011 are still present as is OS-20 and FA-11.[1]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Parking Lot 4521. Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[2,3] All radionuclides of concern listed, with the exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: A lined drainage channel parallels the southeast side of Parking Lot 4521 and runs southwest along G Street.[4] Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[5] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[6,7] Parking Lot 4521 was located on the east and west sides of Radiation Instrument Calibration Building 4011, which handled radioactive materials. This presents a possibility of radiological contamination in the Parking Lot 4521 area.

Radiological Contamination Potential: Class 2 because of stained areas and open storage areas noted in aerial photographs, potential radioactive material migration via surface water flow or airborne release from Building 4011, potential radioactive drainage along G Street, and lack of site investigation.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[3] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[6] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[7] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Due to lack of site investigation, potential radioactive material migration via surface water flow or airborne radiation from Building 4011, stains and open storage areas identified in aerial photographs, and potential radioactive drainage along G Street, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Parking Lot 4521 area. This includes the following Parking Lot 4521 areas:

- Stains, OS-15, and OS-20 identified in aerial photographs in and around Parking Lot 4521 footprint. Unknown stained areas and open storage areas could be a potential source of residual contamination.

- Sanitary sewer that runs west from Building 4011 through Parking Lot 4521 footprint. If radioactive materials were released into the sewer system, residual contamination may exist in the materials inside and surrounding the sewer lines.

- Lined drainage channel along G Street, south of Parking Lot 4521 footprint. The G Street storm drain collects storm water from 17th Street, which in turn collects storm water from buildings using radioactive material; consequently, residual contamination may exist along the G Street drainage.
- Drainage pathways associated with the Parking Lot 4521 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.7.8 Building 4611 Area

Site Description: The Building 4611 area comprises Building 4611 and the land surrounding it near the intersection of 19th and G Streets. Building 4611 is first identified on a 1959 aerial photograph. Industrial planning maps note Building 4611 was a paint spray booth canopy. It is assumed that the building was an open structure for spray painting. The structure was located at the southwest corner of Radiation Instrument Calibration Laboratory Building 4011.[1,2] Figure 2.7.8a provides a current photograph. The research team was unable to find available building-specific drawing(s). Building 4011 is discussed elsewhere in this section. No as-built drawings were located for Building 4611. Plate 1 presents a summary of all identified features for this site.

Building Features: No information was located.

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

Former Use(s): Building 4611 was assumed to be an open structure for spray painting.[1]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: The last legible industrial planning map that specifically identifies Building 4611 is a 1978 map.[2] Building 4611 does not appear on a May 1978 aerial photograph.[3] The building presumably was demolished in 1978. Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4611 were not conducted. The Building 4611 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4310. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (μR/hr) with a maximum rate of 19.4 μR/hr. The average exposure rate for all of Area IV was 14.6 μR/hr with a maximum rate of 21.4 μR/hr. The local background exposure rate outside of Area IV was 15.6 μR/hr with a maximum value of 20.5 μR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 μR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[4]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4611 is identified in a 1959 aerial photograph. In 1959, an open storage area was identified along the southwest side of Building 4011, just north of Building 4611, and portions of a pipeline were visible along G Street southwest of Building 4611. In 1962/63, Building 4611 is included in the open storage area (OS), now identified as OS-15, and a stain is visible. In 1965, Building 4611 is no longer included in OS-15, but the storage area has grown to the north and west. By 1978, Building 4611 is no longer present on aerial photographs.[5]

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[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-15.
[2] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[5] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4611. Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[1,2] All radionuclides of concern listed, with the exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[3] A lined drainage channel parallels the southeast side of Building 4611 and runs southwest along G Street. Two other surface drainage channels, one lined and one unlined, were located just south of G Street, between 19th and 20th Streets. These channels run south into Area III.[4] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[5,6] Building 4611 was located at the southwest corner of Radiation Instrument Calibration Building 4011, which handled radioactive materials. This presents a possibility of radiological contamination in the area of Building 4611 from Building 4011 drainage.

Radiological Contamination Potential: Class 2 because of potential radioactive material migration via surface water flow or airborne release from Building 4011, potential radioactive drainage along G Street, stains and OS-15 identified in aerial photographs, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Due to lack of site investigation, potential radioactive material migration via surface water flow or airborne release from Building 4011, potential radioactive drainage along G Street, and stains and OS-15 identified in aerial photographs, there is a possibility that radionuclide concentrations

[1] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[2] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[5] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[6] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4611 area. This includes the following Building 4611 areas:

- North and west portions of Building 4611 footprint where OS-15 and stains are identified in aerial photographs. Unknown stained areas and open storage areas could be a potential source of residual contamination.

- Lined drainage channel along G Street, south of Building 4611 footprint. The G Street storm drain collects storm water from 17th Street, which in turn collects storm water from buildings using radioactive material; consequently, residual contamination may exist along the G Street drainage.

- Drainage pathways associated with the Building 4611 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.7.9 Building 4612 Area

Site Description: The Building 4612 area comprises Building 4612 and the land surrounding it on 19th Street between F and G Streets. Building 4612 was constructed prior to March 1962 as a Maintenance Building. The building was located south of X-Ray Building 4171 and west of X-Ray Building 4172 and Radiation Instrument Calibration Laboratory of Building 4011.[1] These buildings are discussed elsewhere in this section. Figure 2.7.9a provides a current photograph. The research team was unable to find building-specific drawing(s). No as-built drawings were located for Building 4612. Plate 1 presents a summary of all identified features for this site.

Building Features: A sanitary sewer map shows a sewer line that appears to be located under the Building 4612 site footprint.[2]

Former Use(s): Building 4612 was initially identified as a Maintenance Building. In 1967, it was further identified as a Maintenance/Reclaimed Material Storage Building. By 1972, the building was listed as a Storage Building. The last legible industrial planning map that specifically identifies Building 4612 is a 1982 map.[3]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

[1] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.
[2] *Technical Site Information, Energy Technology Engineering Center (ETEC), GEN-AT-0027, Revision B,* Rockwell International Corporation, August 1993, p. b-23.
[3] Santa Susana Area IV, Atomics International/Energy Systems Group Planning Maps, March 1962–November 1992.

Current Use: Building 4612 was likely demolished in 2000 when Building 4171, directly adjacent to Building 4612, was demolished.[1] Based on available information, the dimensions of the excavation made during building demolition are unknown.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4612 were not conducted. The Building 4612 area was covered as part of the Rockwell/Rocketdyne 1994-1995 Area IV Radiological Characterization Survey. An ambient gamma and walkabout survey was conducted in the area of Building 4310. The average gamma exposure rate for the developed areas of the Santa Susana Field Laboratory Area IV was 13.6 microroentgens per hour (µR/hr) with a maximum rate of 19.4 µR/hr. The average exposure rate for all of Area IV was 14.6 µR/hr with a maximum rate of 21.4 µR/hr. The local background exposure rate outside of Area IV was 15.6 µR/hr with a maximum value of 20.5 µR/hr. According to the survey report, the gamma radiation distribution of Area IV was statistically indistinguishable from the local background gamma radiation distribution. The U.S. Nuclear Regulatory Commission and the State of California specify a limit of 5 µR/hr above the average background of the data set for release of land for radiologically unrestricted use. Ambient gamma regulatory limits were below these acceptable limits.[2]

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: Building 4612 is first identified on a 1965 aerial photograph. The 1965 aerial photograph identifies a large open storage (OS) area, OS-15, containing a probable stain to the west and south of Building 4612. In 1967, a possible stain is located southeast of Building 4612 in OS-15. In 1980 and 1983, two fill areas containing vegetated, mounded material are identified south of Building 4011 and G Street. By 1988, these two areas become part of a larger fill area (FA) identified as FA-11. A 1995 aerial photograph identified a horizontal tank west of Building 4612. Building 4612 is no longer present on a 2005 aerial photograph.[3]

Radionuclides of Concern: The research team did not find evidence of radioactive material use in Building 4612. Radionuclides associated with potential migration from Building 4011 include: americium-241 (Am-241), cesium-137 (Cs-137), cobalt-60 (Co-60), europium isotopes (Eu-152, Eu-154), iridium-192 (Ir-192), lead-210 (Pb-210), plutonium isotopes (Pu-238, Pu-239, Pu-240, Pu-241), potassium-40 (K-40), radium-226 (Ra-226), strontium-90 (Sr-90), tantalum-182 (Ta-182), technetium-99 (Tc-99), thorium isotopes (Th-230, Th-232), tritium (H-3), and uranium isotopes (U-234, U-235, U-238).[4,5] All radionuclides of concern listed, with the

[1] Sapere Consulting, Inc. and The Boeing Company, *Historical Site Assessment of Area IV Santa Susana Field Laboratory, Ventura County, California, Volume 2 – Area IV Site Summaries*, May 2005, p. R-17.
[2] Rockwell International/Rocketdyne Division, *Area IV Radiological Characterization Survey, A4CM-ZR-0011, Rev. A*, August 15, 1996.
[3] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[4] Rockwell International, Rocketdyne Division, *Application for Renewal, State of California Broad Scope "A" Radioactive Materials License #0015-70, RI/RD-93-160, Exhibit 10: Inventory of Radioactive Sources*, Revised August 7, 1995, p. 6.
[5] Internal Correspondence from Bresson, J.F. to Heine, W.F., North American Rockwell Corporation, *Reference: Inspection of Santa Susana Radiographic Installation*, April 18, 1969.

exception of Ir-192 and Ta-182, are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Ir-192 and Ta-182 have half-lives of less than one year and thus do not meet the criteria for analysis. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: Aerial photographs from 1965 to 2005 identify a drainage pathway that flows south from 20th Street to impoundments in Area III.[1] Building 4612 is located north of a lined drainage channel that runs southwest along G Street. Two other surface drainage channels, one lined and one unlined, were located just south of G Street, between 19th and 20th Streets. These channels run south into Area III.[2] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[3,4] Building 4612 was located west of Radiation Instrument Calibration Building 4011, which handled radioactive materials. This presents a possibility of radiological contamination in the area of Building 4612 from Building 4011 drainage.

Radiological Contamination Potential: Class 2 because of stains noted in aerial photographs, potential radioactive material migration via surface water flow or airborne release from Building 4011, and lack of site investigation.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.7 provide a convenient reference for the following recommendations.

Due to lack of site investigation, stains noted in aerial photographs, and potential radioactive material migration via surface water flow or airborne release from Building 4011, there is a possibility that radionuclide concentrations in soil will exceed the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the Building 4612 area. This includes the following Building 4612 areas:

- Sanitary sewer located under Building 4612 site footprint and east and west of building 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-15 identified on aerial photographs south and west of Building 4612 footprint where staining is noted. If radioactive materials were stored in OS-15, contamination could migrate into the Building 4612 area and residual contamination may exist west of the building.

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[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2*, U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.
[3] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[4] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

- Storm drainage area along west side of Building 4612 footprint. The 20th Street storm drain collects storm water from Systems for Nuclear Auxiliary Power Building 4019; consequently, residual contamination may exist along the 20th Street drainage.

- Drainage pathways associated with the Building 4612 area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

2.8 Group 8

The Group 8 index map is presented in Figure 2.8. Following Figure 2.8, the site photograph and layout drawings for each building area within HSA-5B Group 8 are presented. HSA-5B Group 8 includes the 17th Street Drainage area. Group 8 also contains the Building 4011 leach field discussed above in Group 7.

2.8.1 17th Street Drainage Area

Site Description: The 17th Street Drainage is the site of a stormwater channel where a berm was constructed in 1962 permitting the area to serve as a holdup pond. Over time, the area became overgrown with shrubs and trees and filled with silt.[1] The 17th Street Drainage is located south of the intersection of G and 17th Streets, in the central portion of Area IV. The former holdup pond measured approximately 30 feet by 30 feet and is noted as an impoundment (IM-5) in aerial photographs. The entire impacted area measures 2,230 meters.[2,3] Figure 2.8.1a provides a current photograph. There are no as-built drawings associated with the 17th Street Drainage. Plate 1 presents a summary of all identified features for this site.

Building Features: No structures are present in this area.

Former Use(s): A berm was constructed in 1962 around the stormwater channel to provide a 30-foot by 30-foot holdup pond. The reason for construction of the bermed pond is presently not known. The pond cycled through periods of evaporative drying in summer and refilled during the rainy season, causing the low lying area to be marshy. Over time, the area became overgrown and filled with silt. In 1998, the entire drainage channel area was cleared of shrubs and trees.[4,5] In January 1999, the main storm drainage system was re-routed by blocking and plugging the old drainage system. A new route was created along the north side of G Street to keep the stormwater channel dry all year long, presumably for ease of future monitoring and surveying.[6]

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[1] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, p. 6.
[2] Morton, J.R., *Verification Survey of the 17th Street Drainage Area, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, April 14, 2000, p. 3.
[3] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, pgs. 6, 8, 22, 57-60, 64.
[4] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, pgs. 6, 8, 22, 57-60, 64.
[5] U.S. Department of Energy, *17th Street Drainage Area*, Energy Technology Engineering Center (ETEC) Website, http://www.etec.energy.gov/History/17_Street.html, accessed October 12, 2010, p.1.
[6] Ortega, Christina, *Operations Report for 17th Street Decontamination*, The Boeing Company, August 21, 2000, p. 5.

Information from Interviewees: A number of former employees were interviewed about their experience at the SSFL. One recalled information regarding the 17th Street Drainage area. Excerpts from this interview are included below.

Interviewee 12 worked at the Santa Susana Field Laboratory from 1974 to 1995 as a construction inspector. The following excerpt was pulled from the interview.

> *"I can indicate on the aerial photograph you provided a general area that was used for the disposal of miscellaneous debris. It was this general area along the southeastern side of G Street. I don't know if any irradiated material was ever disposed in the area."*[1]

Radiological Incident Reports: None found.

Current Use: The 17th Street Drainage is dry and overgrown with grass and shrubs.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s):

- **1995 Rockwell Area IV Radiological Survey**. During the 1995 Rockwell/Rocketdyne Area IV Radiological Survey, the pond was overgrown and inaccessible making a complete survey of the drainage area impossible. Soil from drainage areas to the north and south of the pond was sampled and found at background or slightly above background radiological activity. No remediation was deemed necessary at the time.[2,3]

- **1997 Rockwell Soil Sampling**. In 1997, Rockwell/Rocketdyne was able to collect soil samples from the pond area. Seven locations were sampled. Two samples indicated cesium-137 (Cs-137) at levels of 13.5 and 14.9 picocuries per gram (pCi/g), the U.S. Department of Energy approved derived concentration guideline limits (DCGLs) of 9.2 pCi/g above background. A radiation survey was then conducted in the areas to identify any locations above.[4]

- **1998 Rockwell Radiological Survey**. In 1998, Rockwell/Rocketdyne mapped and surveyed the entire drainage area. Both walkabout and ambient gamma surveys were conducted. A total of 66 hotspots (areas where total gamma radiation is greater than 5 microroentgens per hour (μR/hr) over background) located in and around the berm and along the drainage pathway south of the berm were identified during the walkabout survey. However, the ambient gamma survey resulted in only one hotspot location. This hotspot and two others with net ambient gamma levels close to 5 μR/hr over background were excavated. To further characterize the hotspot areas, a total of 13 representative surface walkabout hotspot locations were sampled and analyzed. Soil samples were

[1] Interview No. 12 conducted by EPA in 2009.
[2] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, pgs. 6, 8, 22, 57-60, 64.
[3] Internal correspondence from Shao, J. to Rutherford, P., The Boeing Company, *Reference: 17th Street Drainage Area – Radiation Characterization Surveys and Excavation, SHEA-016779*, January 18, 1999. [Note this letter can also be found as Appendix D in RS-00009 above.]
[4] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, pgs. 6, 8, 22, 57-60, 64.

collected at varying depths from the hotspot areas. Several areas immediately to the north and south of the berm showed levels of radionuclides (Cs-137 and thorium-228 (Th-228)) above local background. Four hotspots were found to have background Cs-137 levels as high as 2.11 pCi/g. This is below the DCGL of 9.2 pCi/g. Two hotspots also contained high Th-228 at 6.24 and 4.01 pCi/g, which was above the DCGL of 5 pCi/g. These hotspot areas immediately to the north and south of the berm were excavated and then re-sampled. Post-excavation sampling found the highest Cs-137 activity to be 0.72 pCi.g and the highest Th-228 activity to be 1.4 pCi/g, both below their respective DCGLs.[1,2]

- **1999 Rockwell Final Status Survey**. On June 1, 1999, Rockwell/Rocketdyne performed a final status survey at the 17th Street Drainage. Surface radiation and soil sample measurements indicated that the area met release limits approved by the U.S. Department of Energy (DOE) in 1999, and thus is suitable for release for unrestricted use.[3]

- **1999 ORISE Verification Survey**. On October 27, 1999, the Oak Ridge Institute for Science and Education (ORISE) performed a verification survey of the 17th Street Drainage that included document review, surface scans, exposure rate measurements and soil sampling. Cs-137 ranged from non-detect to 1.6 pCi/g and exposure rates ranged from 14 to 19 μR/hr.[4]

- **1999 California DHS Confirmation Survey**. In 1999, the California Department of Health Services (DHS) performed a confirmation survey of the 17th Street Drainage and recommended the site be released for unrestricted use.[5]

- **2004 Release for Unrestricted Use**. On August 14, 2004, the California DHS released the 17th Street Drainage for unrestricted use.[6]

- **2005 DOE Confirmation of Release**. On February 1, 2005, DOE declared that the Rockwell/Rocketdyne and ORISE surveys had confirmed that DOE and DHS soil cleanup limits had been met, and that the 17th Street Drainage was suitable for release for unrestricted use in 2005.[7]

Radiological Use Authorizations: None found.

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[1] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, pgs. 6, 8, 22, 57-60, 64.
[2] Internal correspondence from Shao, J. to Rutherford, P., The Boeing Company, *Reference: 17th Street Drainage Area – Radiation Characterization Surveys and Excavation, SHEA-016779*, January 18, 1999. [Note this letter can also be found as Appendix D in RS-00009 above.]
[3] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, pgs. 6, 8, 22, 57-60, 64.
[4] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, pgs. 6, 8, 22, 57-60, 64.
[5] Rupo, Roger K., *Confirmatory Survey, 17th Street Drainage Area, Santa Susana Field Laboratory, Boeing-Rocketdyne, Ventura County, California*, 1999, pgs. 1-2.
[6] Correspondence from Bailey, E., California Department of Health Services, Radiologic Health Branch, to Rutherford, P., The Boeing Company, *Reference: In reply to letter 2000RC-2627, Request for Release of t he 17th Street Drainage Area for Unrestricted Use*, dated August 14, 2004.
[7] Lopez, M., *Release of 17th Street Drainage*, U.S. Department of Energy, February 1, 2005, p. 1.

Former Radiological Burial or Disposal Location: None found.

Aerial Photographs: The natural drainage pathway along 17th Street is identified in available aerial photographs as far back as 1957. A 1962/63 aerial photograph identifies light-toned mounded material in the drainage area and by 1965 an impoundment containing liquid is visible. Drainage continues to flow south from 17th Street to the impoundment, IM-5, and then further south into Area III during this time. By 1972, the impoundment area is densely vegetated and ground scarring is noted northwest of the impoundment. The vegetated impoundment area and ground scaring continues to be visible in 1978, 1980, and 1983. In 1980, possible fill areas (FA) are noted west of the former impoundment. In 1980 and 1983, one of two fill areas containing vegetated, mounded material is identified west of the vegetated impoundment. By 1988, the two fill areas become part of a larger fill area, identified as FA-11, west of the vegetated impoundment. Aerial photographs from 1988 through 2005 show a vegetated drainage pathway that runs south of 17th Street into Area III.[1]

Radionuclides of Concern: The principle contaminant of concern at the 17th Street Drainage is Cs-137. Uranium and thorium isotopes have been found in the soil, but always with the accompanying presence of Cs-137. Cesium has been used as a tracer for all potential contaminants. Soil sample analysis has been performed for all gamma emitting radionuclides, americium-241 (Am-241), strontium-90 (Sr-90), and isotopic plutonium (Pu-238, Pu-239, Pu-240), thorium (Th-228, Th-230, Th-232), and uranium (U-234, U-235, U-236, U-238).[2] All radionuclides of concern listed are included for analysis in the August 2009 *Final Field Sampling Plan, Radiological Background Study, Santa Susana Field Laboratory*. Table 3.3 presents a summary of radiological contaminants of concern.

Drainage Pathways: The 17th Street Drainage is the site of a stormwater channel where a berm was constructed in 1962 to permit the area to serve as a holdup pond.[3] The general slope of Area IV is in a southerly direction. Water runoff is directed to the retention reservoirs which are part of the SSFL industrial effluent control system. Liquid effluent discharge from the final retention pond into the Bell Canyon drainage occurs only after controlled effluent holdup and sampling.[4,5]

Radiological Contamination Potential: Class 1 due to past Cs-137 detection.

Recommended Locations for Sediment/Soil Sampling:

Plate 1 and Figure 2.8 provide a convenient reference for the following recommendations.

Extensive soil sampling is recommended in the 17th Street Drainage area. As discussed above, previous investigation found radiological contamination in 17th Street Drainage area and

[1] Kartman, A.S., *Aerial Photographic Analysis of Santa Susana Field Laboratory – Area IV, Ventura County, California, Volume 1 & 2,* U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, March 2010.
[2] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, pgs. 6, 8, 22, 57-60, 64.
[3] Liddy, P., *17th Street Drainage, Final Status Survey, RS-00009*, The Boeing Company, September 12, 1999, p. 6.
[4] Chapman, J. A., *Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; And a Storage Yard West of Buildings T626 and T038, GEN-ZR-0010,* Rockwell International, Rocketdyne Division, August 26, 1988, p. 17.
[5] Map located at: http://www.dtsc-ssfl.com/files/maps/SSFL%20-%20Western%20Half.pdf.

previous characterization studies 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 above the standard required by the December 2010 Administrative Order on Consent. Therefore, additional characterization is recommended for the 17th Street Drainage area. This includes the following 17th Street Drainage areas:

- Hotspots identified in past surveys, including areas immediately north and south of the berm. Although hotspot areas were excavated in past surveys, residual contamination above the standards of the December 2010 Administrative Order on Consent may exist.

- Drainage pathways associated with the 17th Street Drainage area and outside Area IV as proposed by the field sampling plan. Residual contamination may exist in drainages outside of Area IV.

3.0 RADIONUCLIDE LIST

3.1 U.S. Atomic Energy Commission Special Nuclear Material License

The first license issued by the U.S. Atomic Energy Commission (AEC) for the SSFL site was Special Nuclear Material License No. SNM-21. It was initially issued on April 6, 1956, for use at the Canoga Park site. License No. SNM-21 authorized Atomics International (AI) to receive and possess 50 grams of uranium, enriched in uranium-235 (U-235), for use in fission counter tubes. License No. SNM-21 was amended 79 times in its 40-year history to increase the number and type of nuclear materials that could be handled at the Canoga Park and SSFL sites. This license was terminated on September 27, 1996. In February 1975, the AEC became known as the Nuclear Regulatory Agency (NRC) and License No. SNM-21 became an NRC license. License No. SNM-21 applies to company owned, not federally owned facilities. This license does not apply to the HSA-5B subarea.

3.2 U.S. Atomic Energy Commission Critical Experiments Facility License

On October 3, 1960, the AEC authorized Atomics International, under License No. CX-17, to possess and operate a separable-half type critical experiments facility at power levels not exceeding 200 watts (thermal) in Building 100 (now known as Building 4100). Atomics International conducted this research under contract to the Southwest Atomic Energy Associates of Shreveport, Louisiana. The license permitted the possession "and use of special nuclear materials as follows:

- 25 kilograms of U-233 and 110 kilograms of U-235 as fuel for the reactor;
- 135 grams of U-233, 1,135 grams of U-235, and 135 grams of Pu-239 in foils and capsules for use in connection with operation of the reactor;
- 0.5 gram each of U-233, U-235, and Pu-239 in fission counters for use in connection with operation of the reactor; and
- 32 grams of Pu in encapsulated neutron sources for use in connection with operation of the reactor."

License No. CX-17 also permitted the possession "and use of source materials as follows:

- 656 kilograms of Th-232 for use in the core and buffer regions of the reactor;
- 700 grams of natural uranium in foils and capsules for use in connection with operation of the reactor; and
- 0.5 gram each of U-234, U-236, and U-238 in fission counters for use in connection with operation of the reactor."

License No. CX-17 also permitted the possession "and use of 0.5 gram of Np-237 in fission counters for use in connection with operation of the reactor and to possess, but not to separate such byproduct materials as may be produced by operation of the reactor."

License No. CX-17 was amended 10 times before it was terminated on October 6, 1980. It does not apply to the HSA-5B subarea.

3.3 California Department of Public Health Radioactive Material License

On September 11, 1963, the State of California, Department of Public Health issued Radioactive Material License No. 0015-59 to Atomics International. This license authorized the possession and use of a wide range of radioactive materials at the De Soto Avenue, Canoga Park, and SSFL sites as listed in Table 3.1, below.

Table 3.1
Radioactive Materials Covered by License No. 0015-59

Radioactive Material (element and mass number)	Chemical and/or Physical Form	Maximum Quantity that Licensee may Possess
Any byproduct material between atomic number 3 and 83	Any	7 curies of each byproduct material between atomic number 3 and 83
Antimony-124	Any	50 curies
Iridium-192	Any	70 curies
Cobalt-60	Sealed sources	10 sources not to exceed 400 curies each
Hydrogen-3	Any	550 curies
Polonium-210	Any	150 curies
Any byproduct material	Separated from irradiated thorium and uranium samples	250 microcuries total
Hydrogen-3	Titanium tritide foil (U.S. Nuclear Corporation)	500 millicuries
Hydrogen-3	Titanium tritide foil (U.S. Radium Corporation)	1 curie
Strontium-90	Sealed source (U.S. Nuclear Corporation Model 312)	5 microcuries
Radium-226	Any	2,000 milligrams
Radium-226	Sealed neutron sources	500 milligrams
Cobalt-60	Sealed source (U.S. Nuclear Corporation Model 338)	1 source not to exceed 5 curies
Cobalt-60	Sealed source (Isotopes Specialties Company Model 338)	1 source not to exceed 5 curies
Cerium-144	Sealed source (Isotopes Specialties Company Model 160)	50 microcuries
Iridium-192	Sealed source (Technical Operations Model A424-1)	1 source not to exceed 20 curies
Radium-226	Sealed sources (NRC Equipment Corporation)	Seven sources not to exceed 0.4 milligram each
Strontium-90	Sealed sources	Two sources of 3 millicuries each
Americium-241	Any	2 millicuries
Natural or depleted uranium	Any	20,000 pounds
Natural thorium	Any	700 pounds

This license covered the use and possession of radioactive materials outside the former ETEC boundary. It does not apply to the HSA-5B subarea. Up until December 1969, there had been 39 amendments to this license. The radioactive materials covered in the 39th amendment are listed in Table 3.2, below.

Table 3.2
Radioactive Materials Covered by License No. 0015-59, Amendment No. 39

Radioactive Material (element and mass number)	Chemical and/or Physical Form	Maximum Quantity that Licensee may Possess
Any radionuclide with atomic number 3 through 83	Any	25 curies for any one radionuclide
Antimony-124	Any	100 curies
Iridium-192	Any	100 curies
Cobalt-60	Sealed sources	10 sources not to exceed 400 curies each
Hydrogen-3	Any	10,000 curies
Polonium-210	Any	150 curies
Krypton-85	Any	100 curies
Neptunium-237	Any	100 microcuries
Radium-226	Any except as neutron sources	5 grams
Radium-226	Sealed neutron sources	500 milligrams
Cobalt-60	Sealed source (U.S. Nuclear Corporation Model 338)	1 source not to exceed 5 curies
Cobalt-60	Sealed source (Isotopes Specialties Company Model 338)	1 source not to exceed 5 curies
Cobalt-60	Sealed source (Lockheed Nuclear Products Dwg 442-1001)	25,000 +/- 2,500 curies in 12 sources
Iridium-192	Sealed source (Technical Operations Model A424-1)	4 sources not to exceed 100 curies each
Radium-226	Sealed sources (NRC Equipment Corporation)	Seven sources not to exceed 0.4 milligram each
Califonium-252	Sealed source (Oak Ridge)	2 sources not to exceed 550 microcuries each
Any radionuclide with atomic number 3 through 83	Any	Not to exceed 100 curies for any one radionuclide
Promethium-147	Promethium oxide	150,000 curies
Americium-241	Any	10 curies
Natural or depleted uranium	Any	20,000 pounds
Natural thorium	Any	1,000 pounds
Tantalum-182	Metal	500 curies
Natural or depleted uranium	Any	50,000 pounds
Mixed fission products (Hot Lab)	Any	10,000,000 curies
Any radionuclide with atomic number 3 through 83 (Hot Lab)	Any	100,000 curies for any one radionuclide

This license was amended 64 times up until August 2, 1979, when the license number was changed to No. 0015-70. This license number was changed a second time to No. 0015-19 on December 5, 1996. As of August 27, 2010, there had been 110 amendments to this license. This license applies to buildings outside of the ETEC boundary. It does not apply to the HSA-5B subarea.

3.4 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. In the table below, certain radionuclides mentioned in source documents 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: Sb-125 and Cs-134. The September 23, 2010 Stakeholder Technical Meeting Action Items Memo describes the radionuclides contained in soil analytical suites, the sample analytical approach, and provides explanations for deleting certain radionuclides from analysis.

Table 3.3
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

Table 3.3 (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
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
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

Table 3.3 (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
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
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

Table 3.3 (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
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
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

Table 3.3 (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
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
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

Table 3.3 (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
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
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

Table 3.3 (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
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
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

Table 3.3 (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
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
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

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4.0 REACTOR/CRITICALITY FACILITIES/SIGNIFICANT SITES WORKS CITED

4.1 BUILDING 4010

Facility Name	Building No.	Period of Operation	Notes
Systems for Nuclear Auxiliary Power (SNAP) Experimental Reactor Facility (SER) / SNAP 8 ER	4010	1959 - 1965	

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4.2 BUILDING 4012

Facility Name	Building No.	Period of Operation	Notes
Systems for Nuclear Auxiliary Power (SNAP) Critical Test Facility	4012	1961 - 1971	

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4.3 BUILDING 4019

Facility Name	Building No.	Period of Operation	Notes
Systems for Nuclear Auxiliary Power (SNAP) Flight System Facility	4019	1963 - 1965	

Building 4019 Cited Documents

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Legend

Subarea 5B Groups

Centerline Roads
- Primary Roads
- Secondary Roads
- Tertiary Roads

Buildings
- Demolished
- Existing
- Parking Lots

Surface Water
- Intermittent Stream
- Permanent Stream
- Surface Water
- Lined Channel

Tanks
- Above ground Storage Tank
- Underground Storage Tank
- Unknown Tank Type
- French Drain Holding Tank
- Sump
- Dry Well
- Tank Footprint
- Drain
- Well
- French Drain
- Drainage
- Leach Field
- Septic System

Aerial Photography Data
- Aerial Photography Features
- Septic Tank
- Leach Field
- Cooling Fan
- Other

Utilities
- Gas
- Storm Drain
- Sanitary Sewer
- Sanitary Waste
- Water
- Water (Removed)

Surface Features
- Channel
- Drain
- Drain
- Drainage Divide
- Gutter
- Tank
- Tank
- Vault
- Well

Aerial Photography Descriptors

Type	Description
B	Building
CONT	Container
CR	Crates
DB	Debris
DG	Disturbed Ground
DTM	Dark Tone Material
EX	Excavation
FA	Fill Area
GS	Ground Scar
HT	Horizontal Tank
IM	Impoundment
LTMM	Light Toned Mounded Material
MTMM	Medium Toned Mounded Material
OS	Open Storage
PA	Processing Area
PL	Pipeline
POSS	Possible
PROB	Probable
SS	Smoke Stack
ST	Stain
S-T	Storage Tank
UO	Unidentified Object
VT	Vertical Tank
WDA	Waste Disposal Area

N

0 50 100 200
Scale In Feet

Historical Site Assessment
Final Technical Memorandum - HSA-5B

Plate 1
Subarea HSA-5B
Santa Susana Field Laboratory

U.S. EPA Region 9

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Map Source: HGL
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Updated: 11/02/2010 12:08:14 PM TJ

HGL

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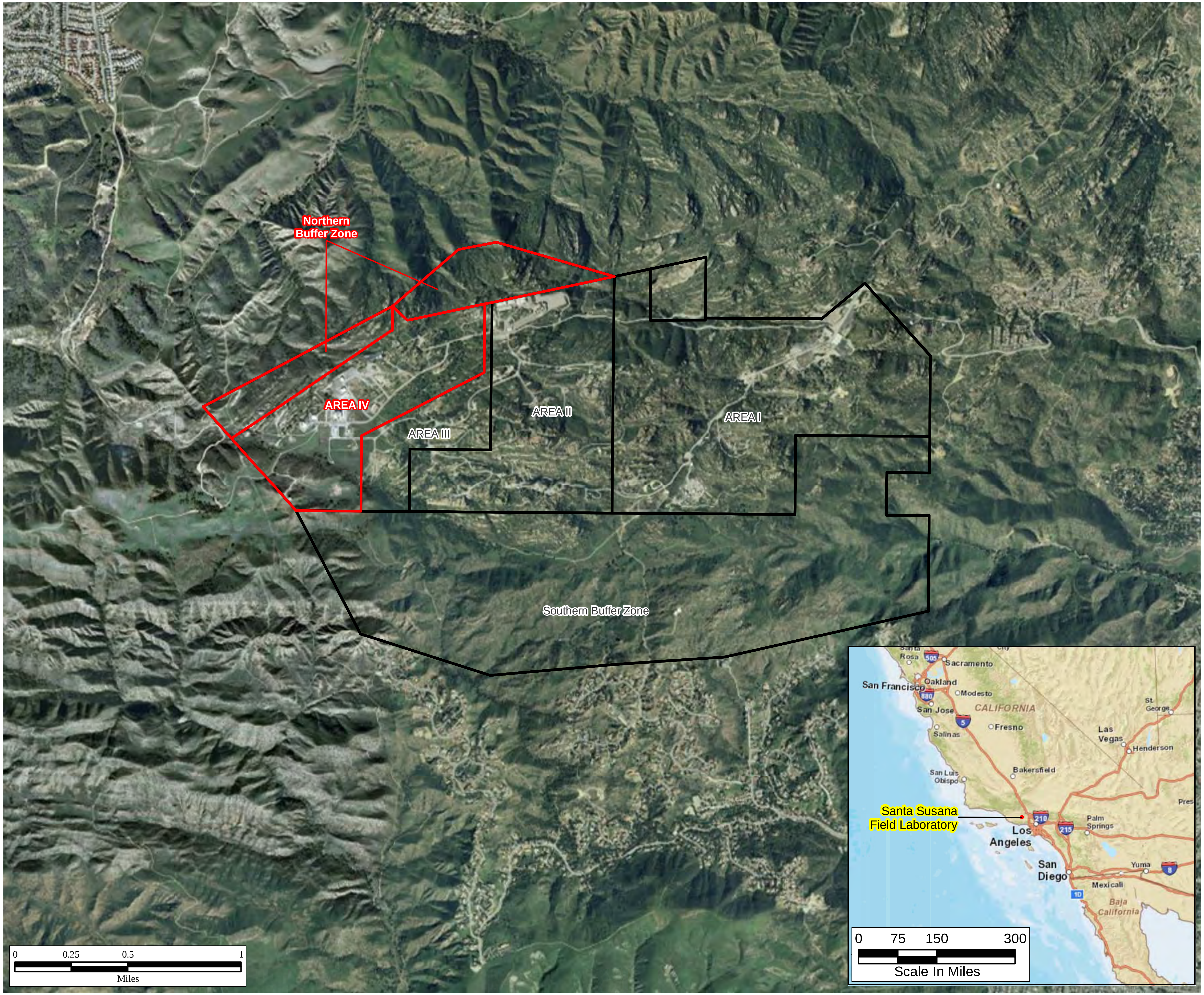
Historical Site Assessment
Final Technical Memorandum - HSA-5B

Figure 1.1
Site Location
Santa Susana Field Laboratory

U.S. EPA Region 9



Legend

EPA Study Area Boundary; Area IV and Northern Buffer Zone

Santa Susana Field Laboratory Property Boundary

N

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Revised: 09/03/2010 TJ
Sorce: CaSil, NAIP 2009; Boeing 2008

HGL HydroGeoLogic, Inc

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Historical Site Assessment
Final Technical Memorandum - HSA-5B

Figure 1.2
General Site Layout for
Area IV/HSA Subareas
Santa Susana Field Laboratory

U.S. EPA Region 9

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Legend

HSA Subarea

Buildings

Existing

Removed

N

0 250 500 1000

Scale In Feet

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Created: CLimoges
Revised: 09/03/2010 TJ
Sorce: Boeing Company, 2008
CIRGIS, 2007

HGL HydroGeoLogic, Inc

Redacted

Historical Site Assessment
Final Technical Memorandum - HSA-5B

Figure 1.3
Subarea HSA-5B
Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

Buildings

Existing

Removed

Surface Water

Lined Channel

Intermittent Stream*

Pipe (Unknown Type)

*Intermittent streams also represent unlined channels.

N

0 50 100 200

Scale In Feet

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HGL HydroGeoLogic, Inc

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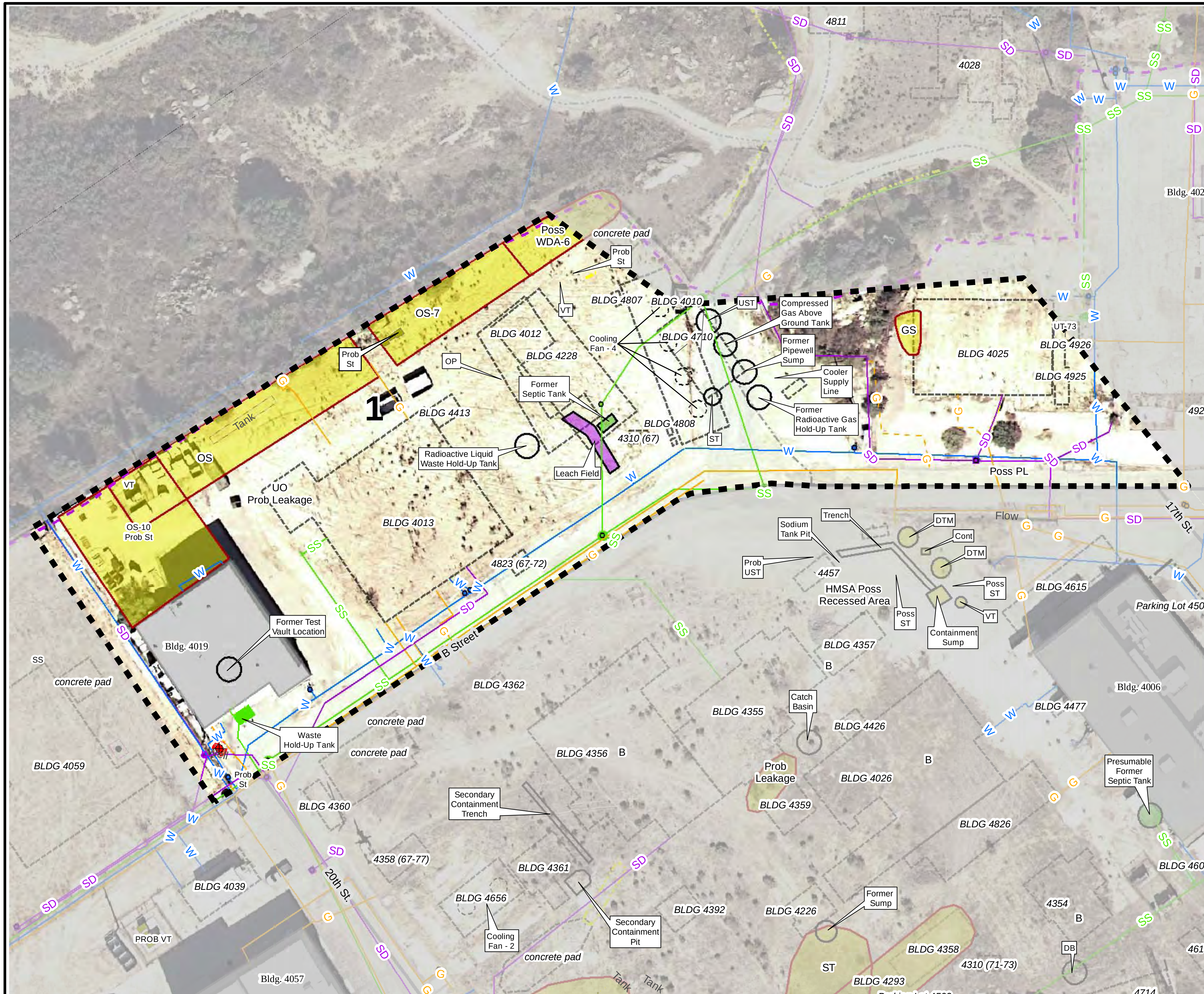

Historical Site Assessment
Final Technical Memorandum - HSA-5B

Figure 2.1
Area IV Subarea 5B-1
Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

- Subarea 5B-1 Boundary
- Primary Roads
- Secondary Roads
- Underground Storage Tank
- Unknown Tank Type
- Sump
- Dry Well
- Tank Footprint
- Above ground Storage Tank
- Demolished Bldg.
- Existing Bldg.
- Parking Lots
- Drainage
- Drain
- Well

B	Building
CONT	Container
CR	Crates
DB	Debris
DG	Disturbed Ground
DTM	Dark Tone Material
EX	Excavation
FA	Fill Area
GS	Ground Scar
HT	Horizontal Tank
IM	Impoundment
MTMM	Medium Toned Mounded Material
OS	Open Storage
PA	Processing Area
PL	Parking Lot
POSS	Possible
PROB	Probable
S-T	Storage Tank
SS	Smoke Stack
ST	Storage
UO	Unidentified Object
VT	Vertical Tank
WDA	Waste Disposal Area

Aerial Photo Features
- Aerial Photography Features
- Leach Field
- Other

Surface Water
- Intermittent Stream
- Permanent Stream
- Surface Water
- Lined Channel
- French Drain
- Drainage
- Leach Field
- Septic System

Utilities
- Channel
- Drain
- Drain
- Drainage Divide
- Gutter
- Tank
- Tank
- Vault
- Well
- G Gas
- SD Storm Drain
- SS Sanitary Sewer
- W Water

0 25 50 100
Scale In Feet

N

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HGL HydroGeoLogic, Inc

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.1a
Building 4010
Site Photograph

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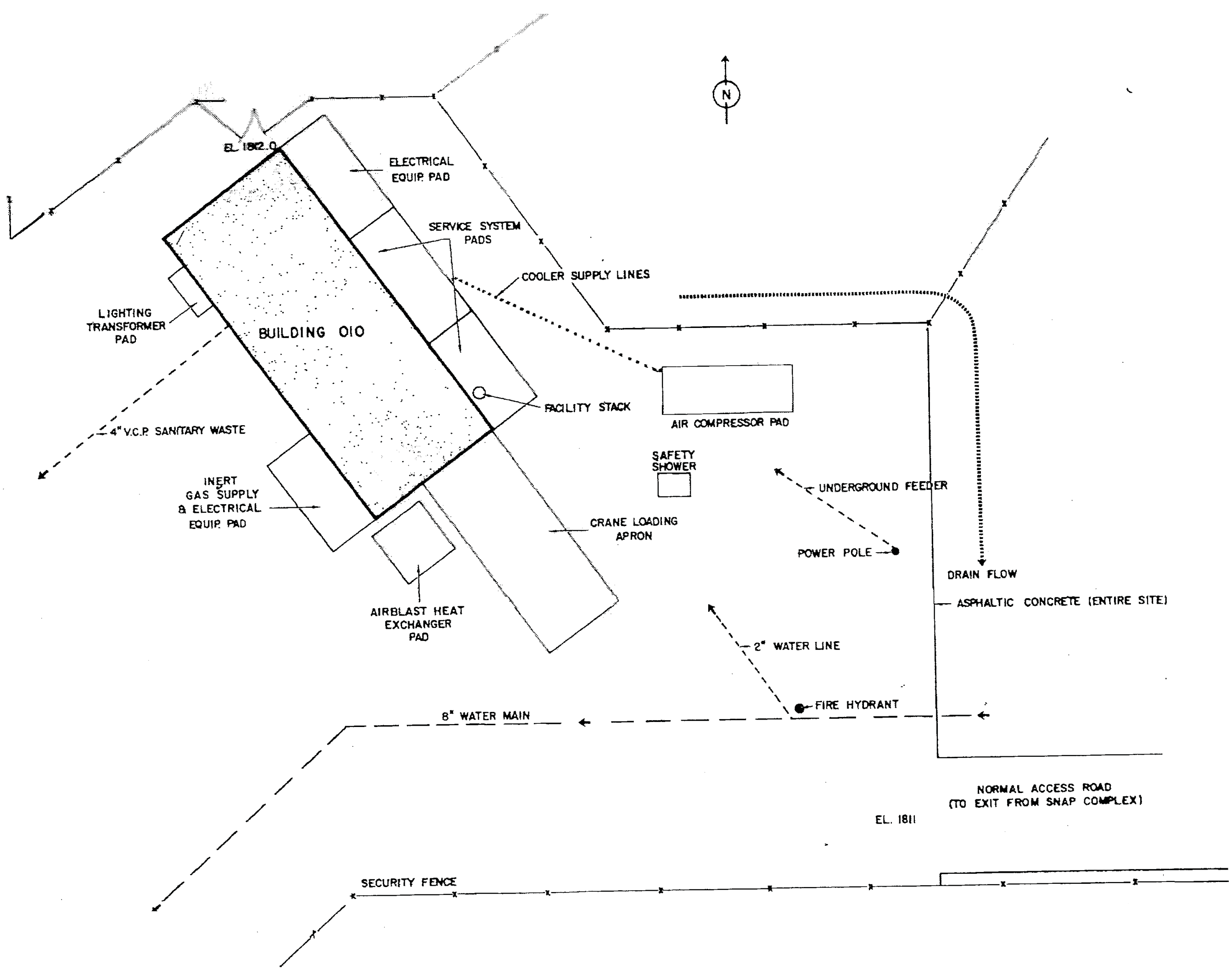

Building 4010 Plot Plan

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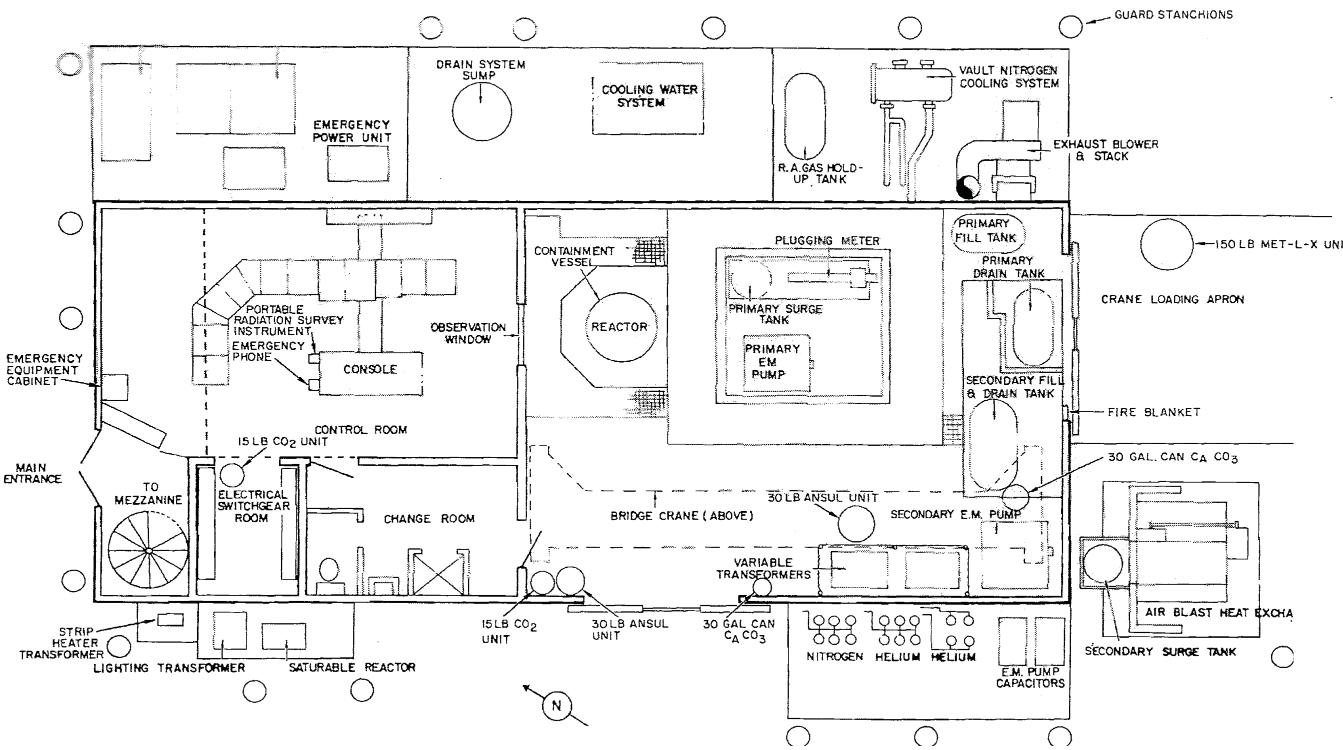

SNAP 8 Experimental Reactor Building 4010

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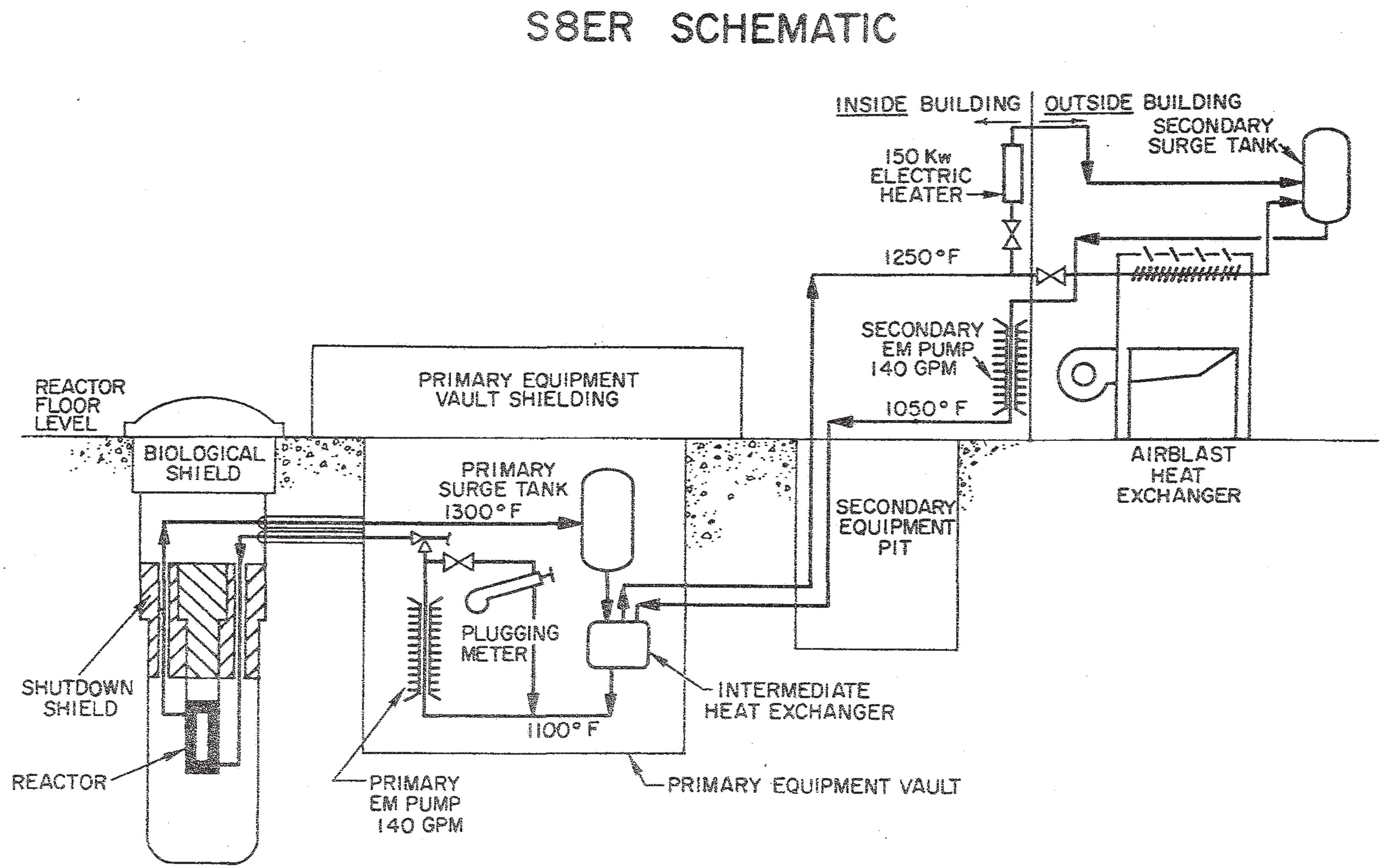
U.S. EPA Region 9

Figure 2.1.1c
Building 4010
Floor Plan



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U.S. EPA Region 9

Figure 2.1.1d
SNAP 8 ER
Schematic Diagram

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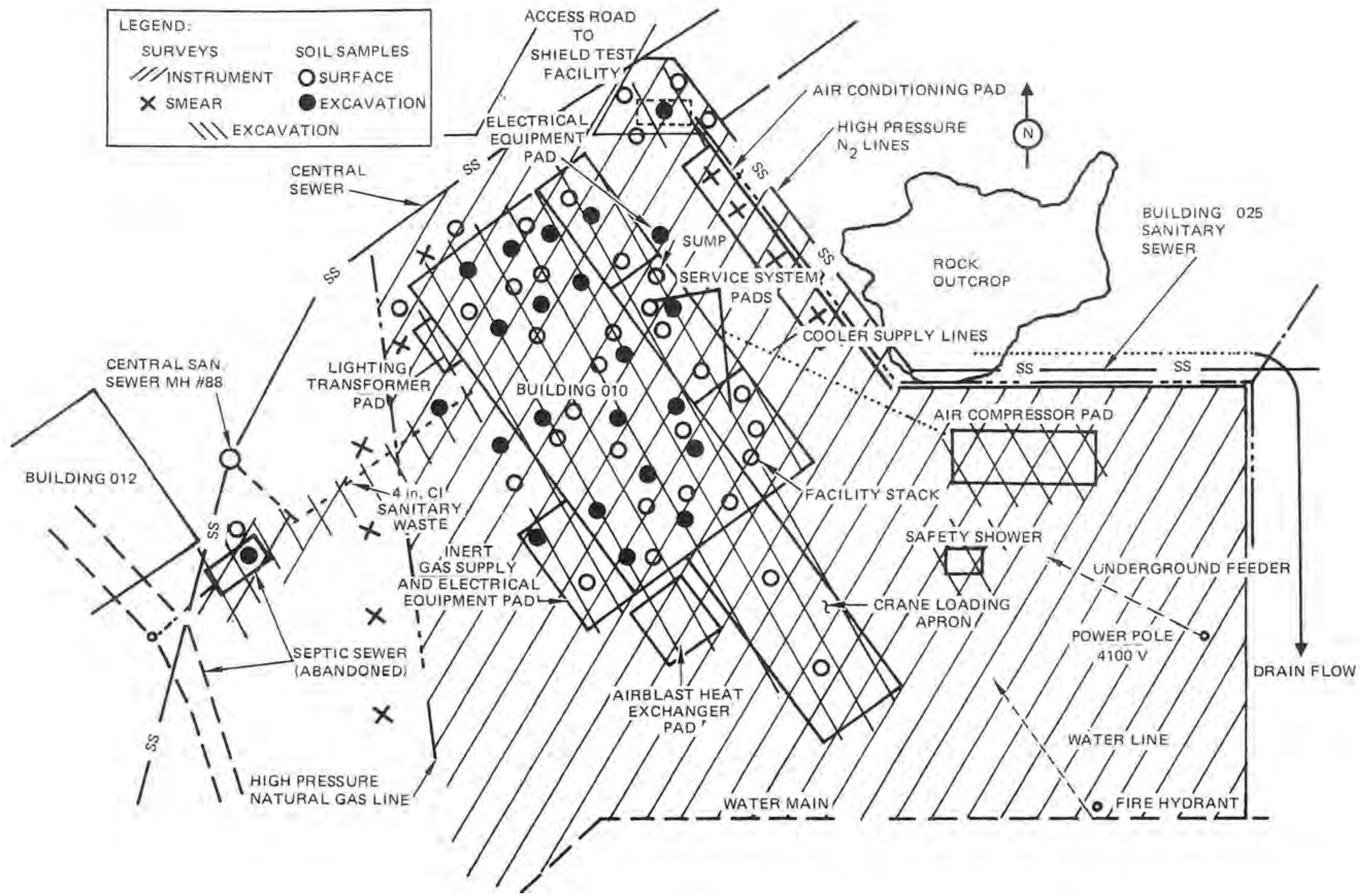

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U.S. EPA Region 9

Figure 2.1.1.e
S8ER Faculty Survey Plot

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Source: Boeing Company, 2008*

U.S. EPA Region 9

**Figure 2.1.2a
Building 4012
Site Photograph**

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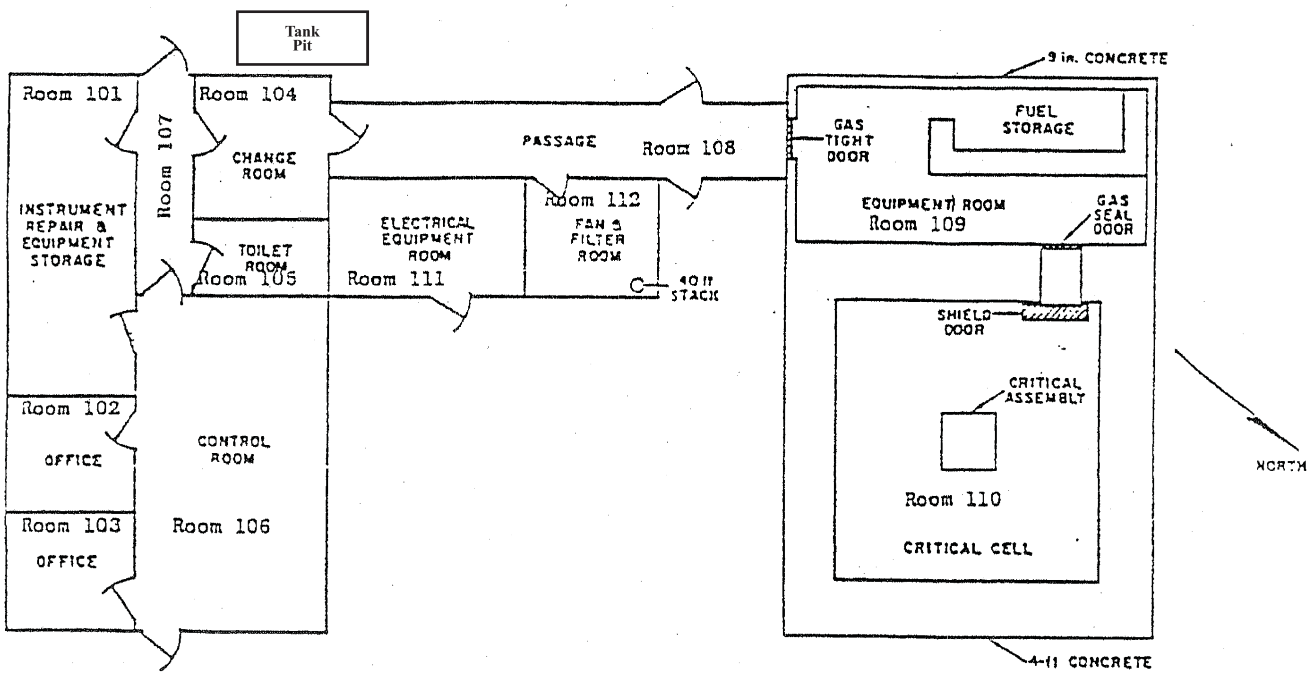

Original Building 4012 Floor Plan

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.2b
Building 4012
Floor Plan

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.3a
Building 4013
Site Photograph

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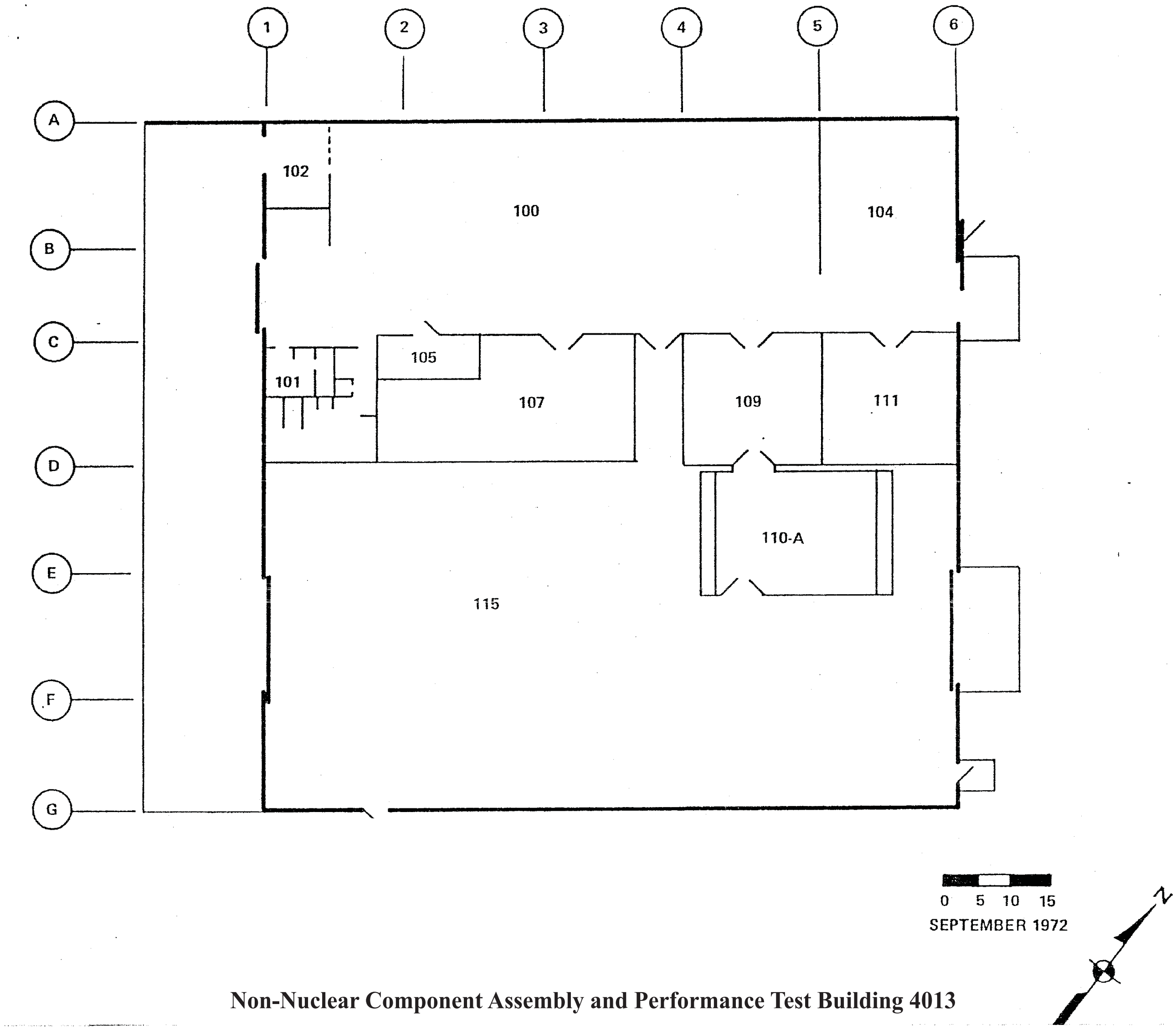

Non-Nuclear Component Assembly and Performance Test Building 4013

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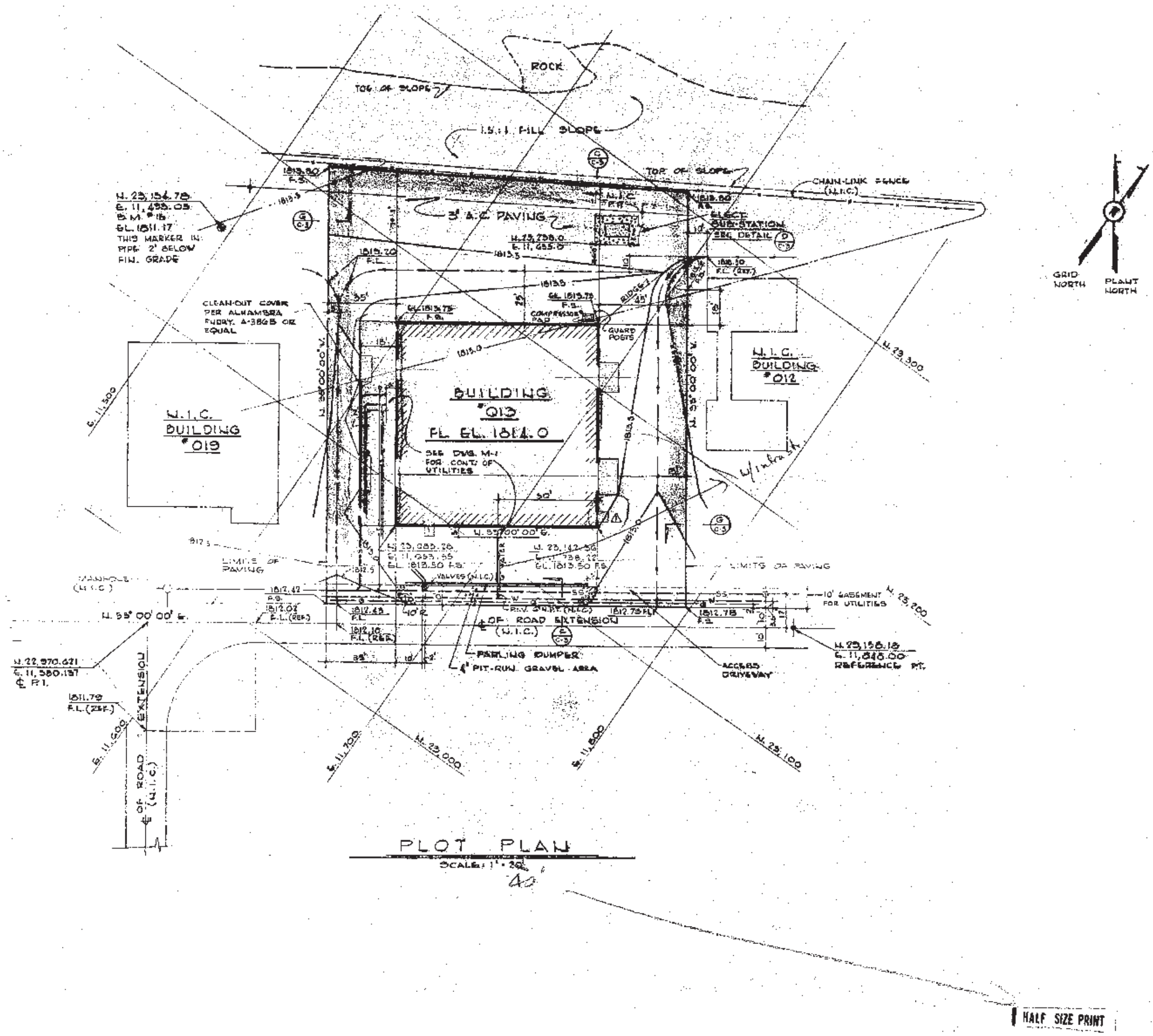
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.3b
Building 4013
Floor Plan



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U.S. EPA Region 9

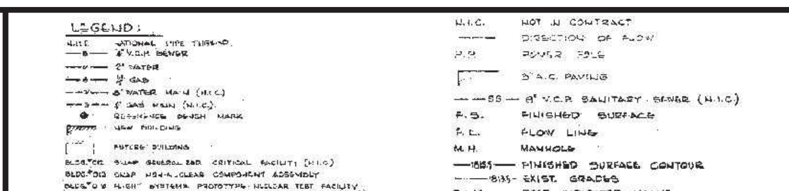
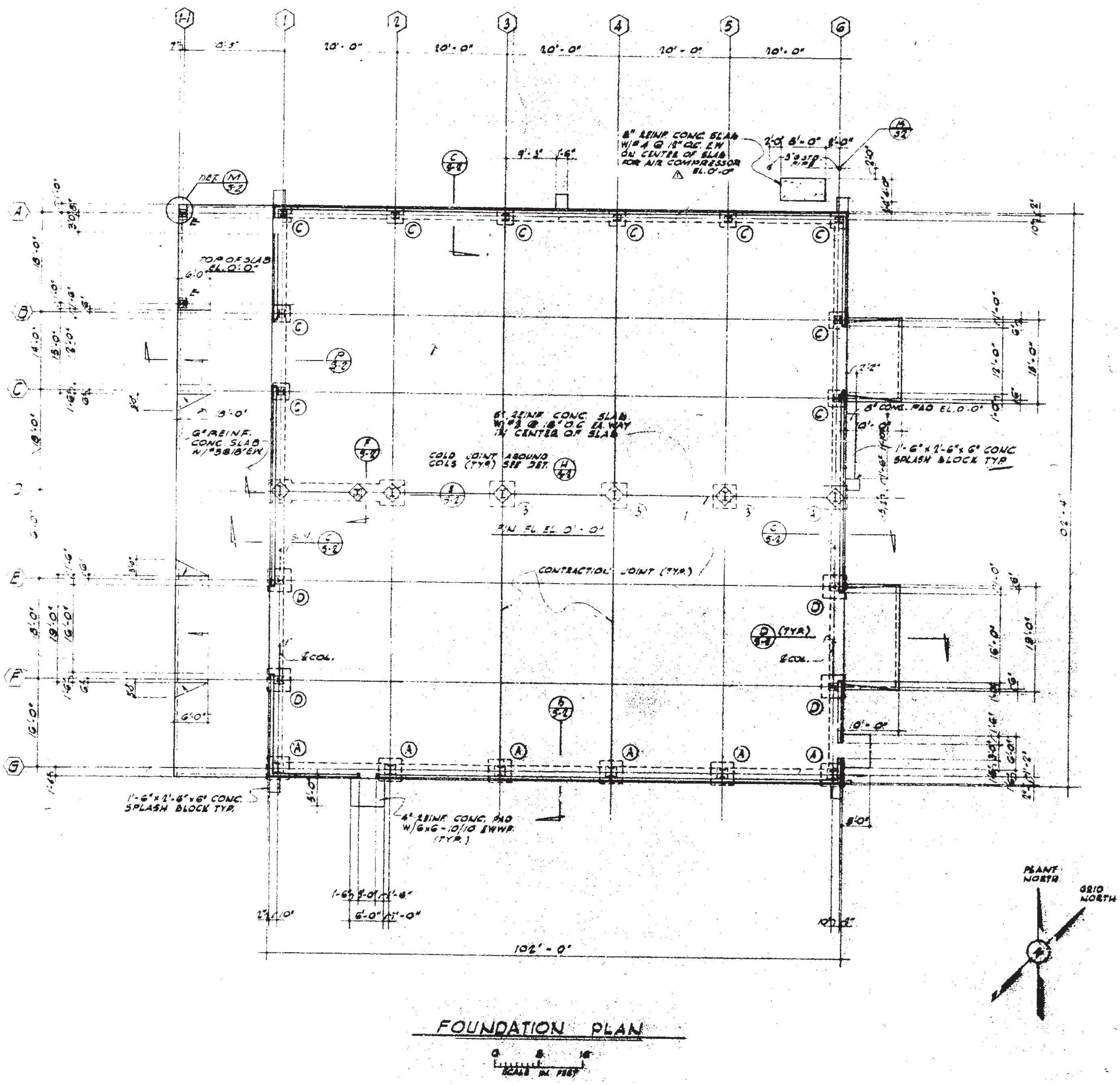


Figure 2.1.3c
Building 4013
Plot Plan



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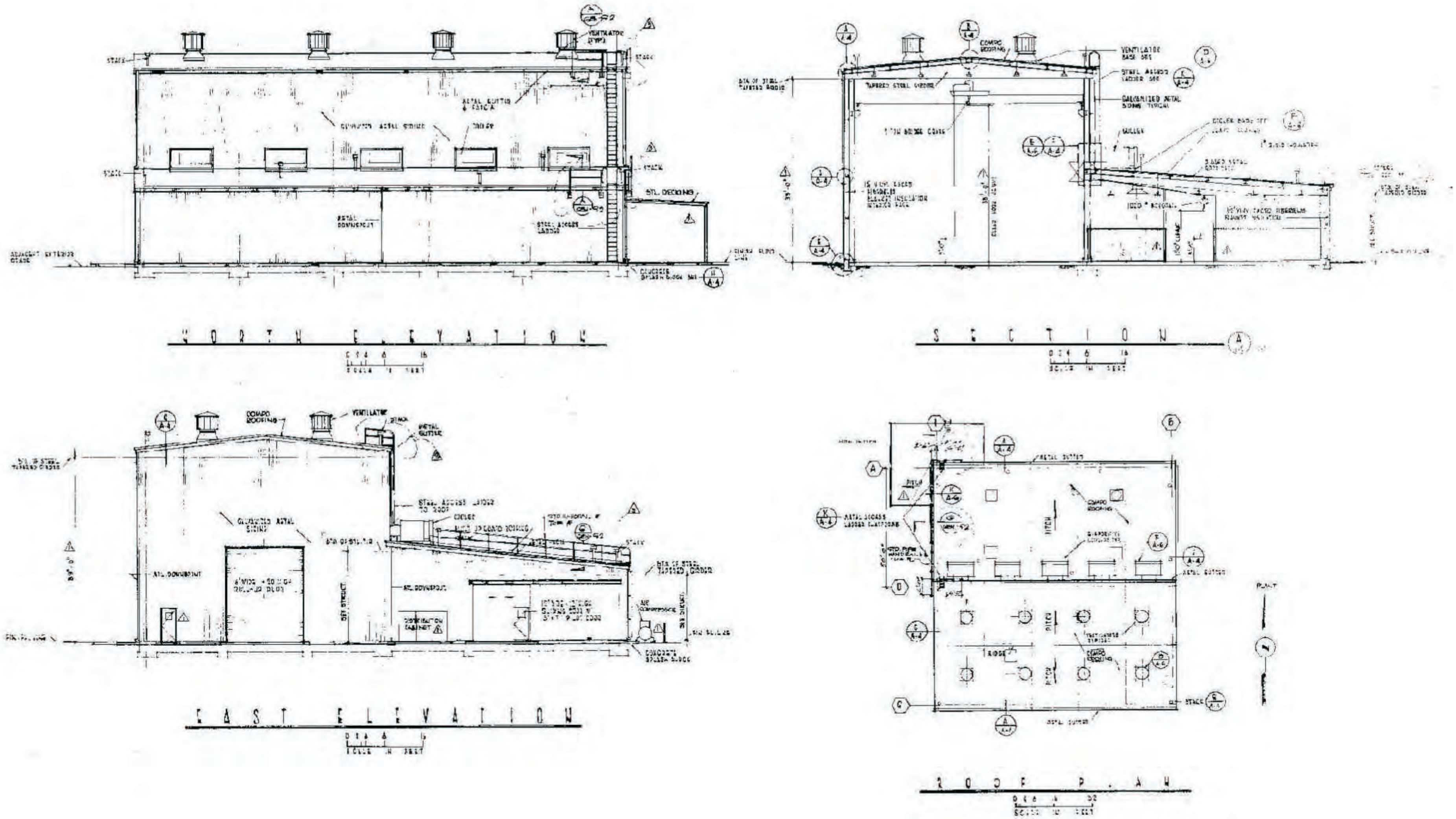
U.S. EPA Region 9

Figure2.1.3d
Building 4013
Foundation Plan



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U.S. EPA Region 9

Figure 2.1.3e
Building 4013
Elevations and Roof

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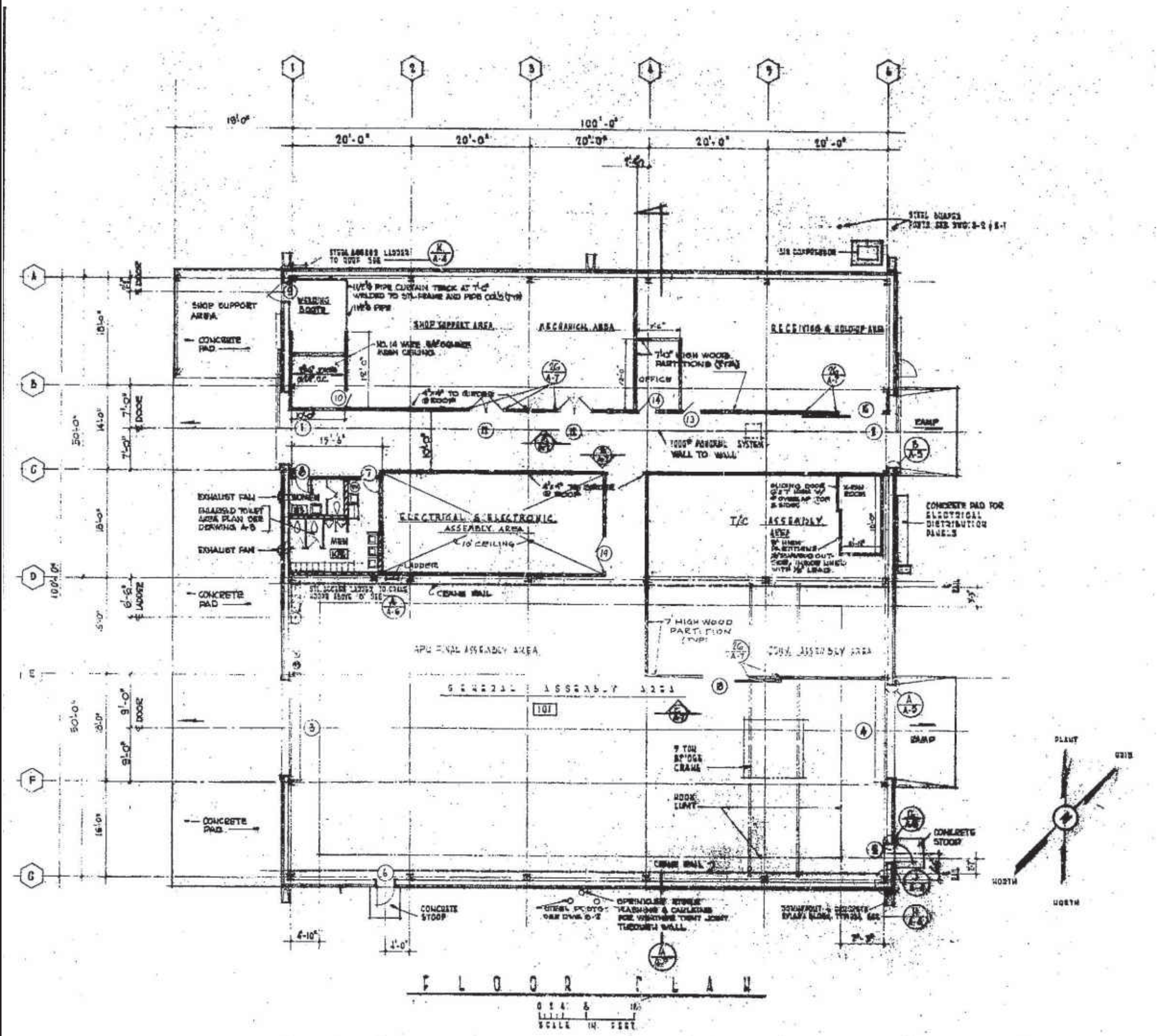

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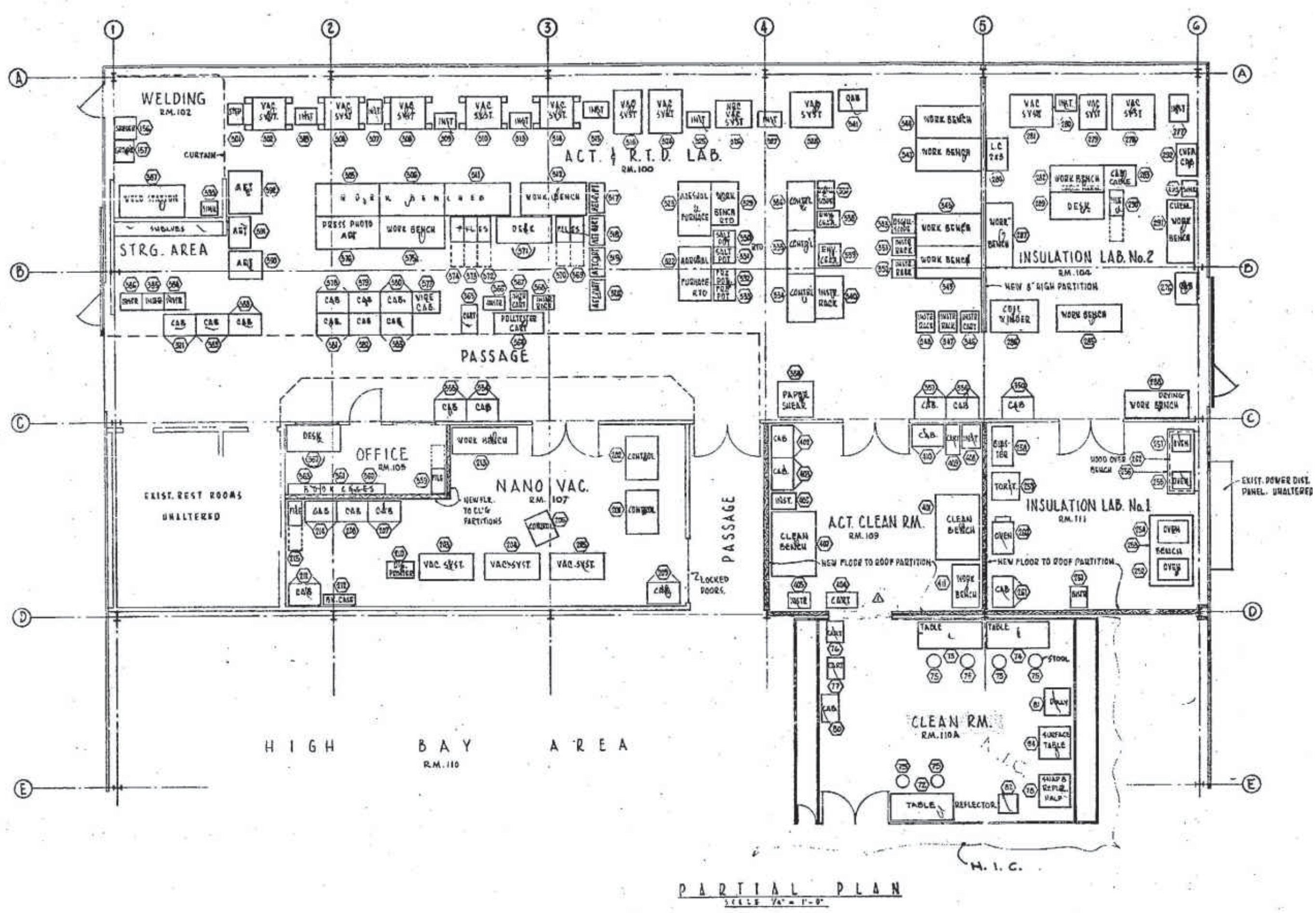
Figure 2.1.3f
Building 4013
Floor Plan



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U.S. EPA Region 9

Figure 2.1.3g
Building 4013
Reactor Development
Plan

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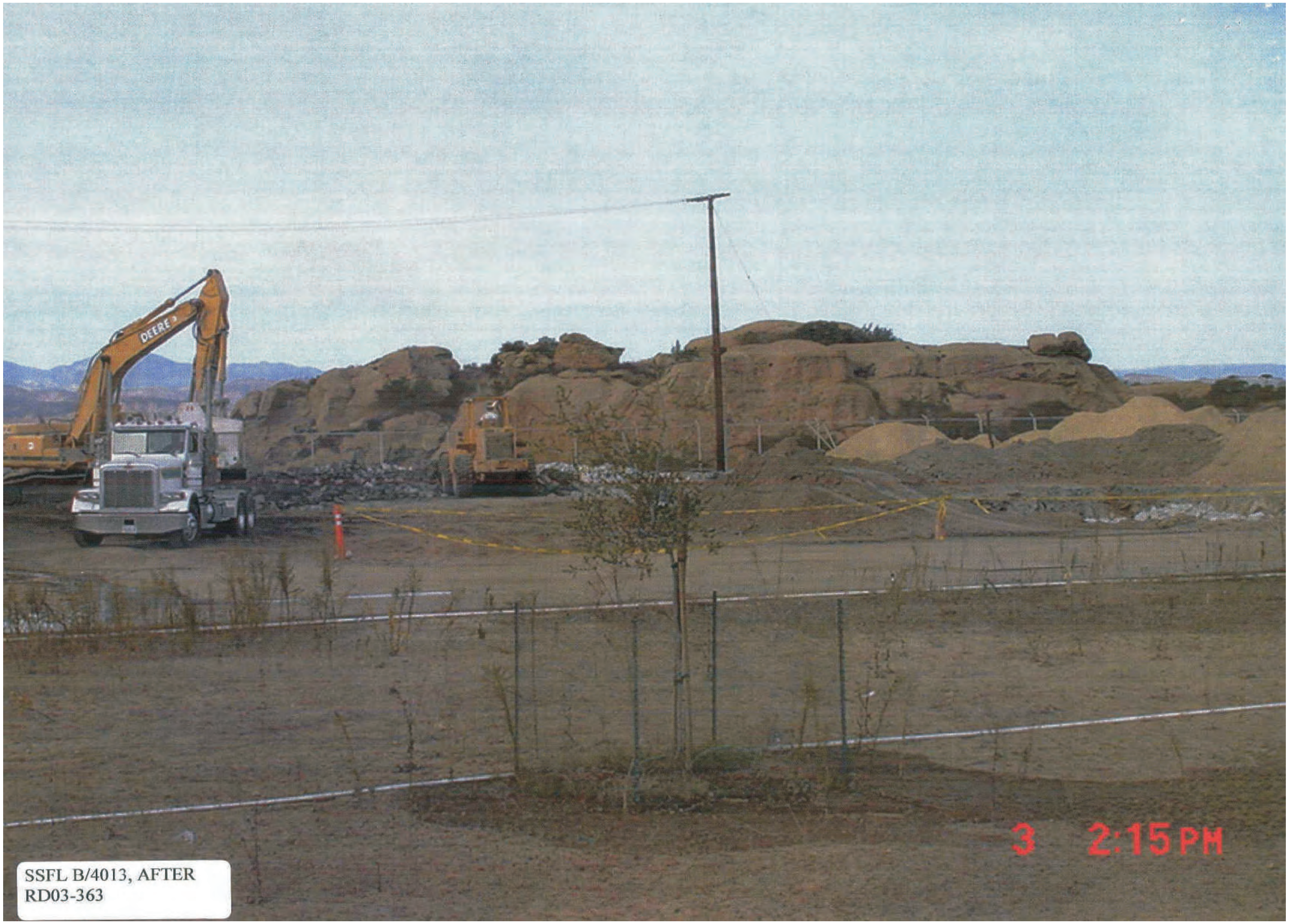
U.S. EPA Region 9

Figure 2.1.3h
Building 4013
Before Demolition
Photograph



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U.S. EPA Region 9

Figure 2.1.3i
Building 4013
After Demolition
Photograph

Redacted

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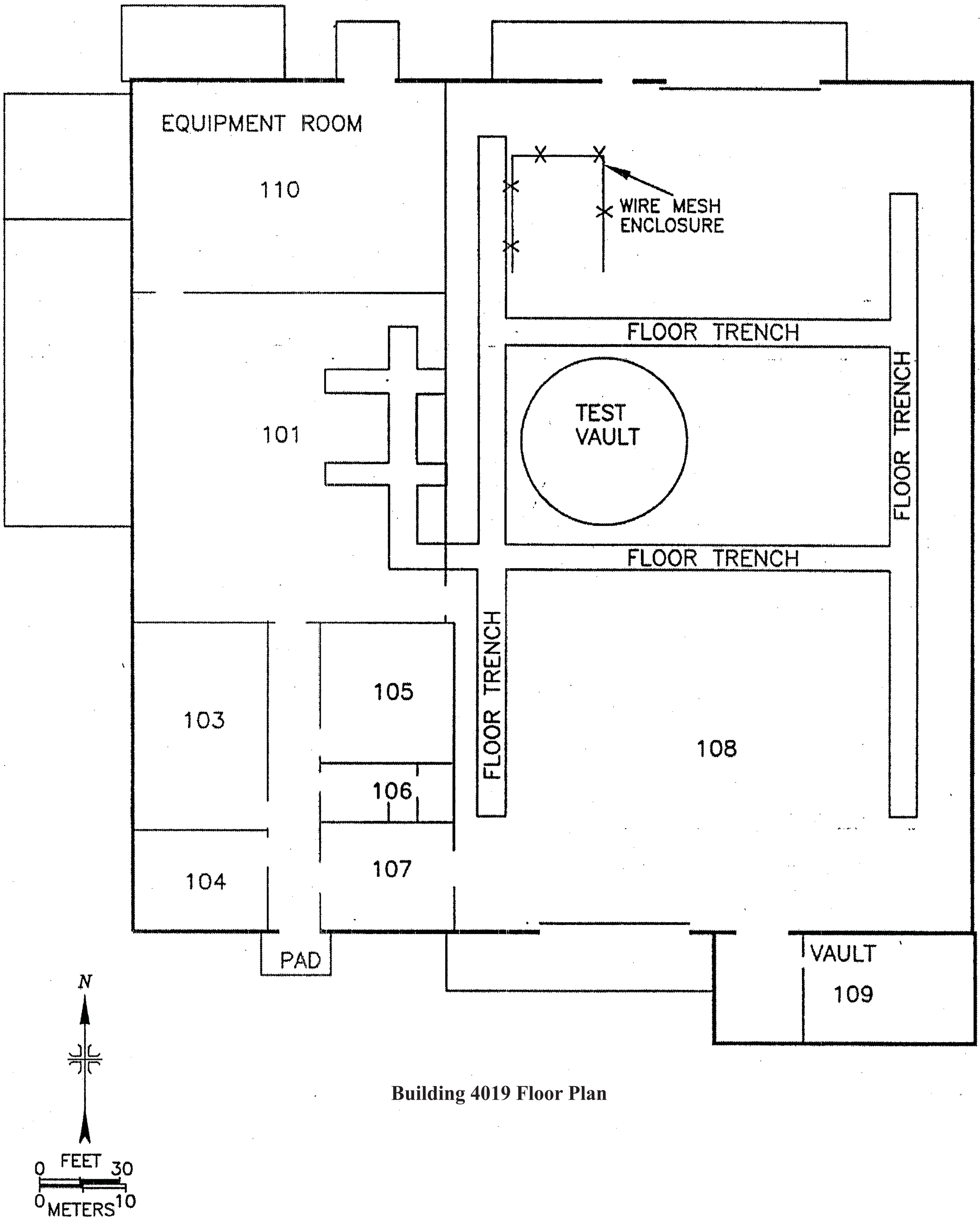
U.S. EPA Region 9

Figure 2.1.4a
Building 4019
Site Photograph



Building 4019 Floor Plan

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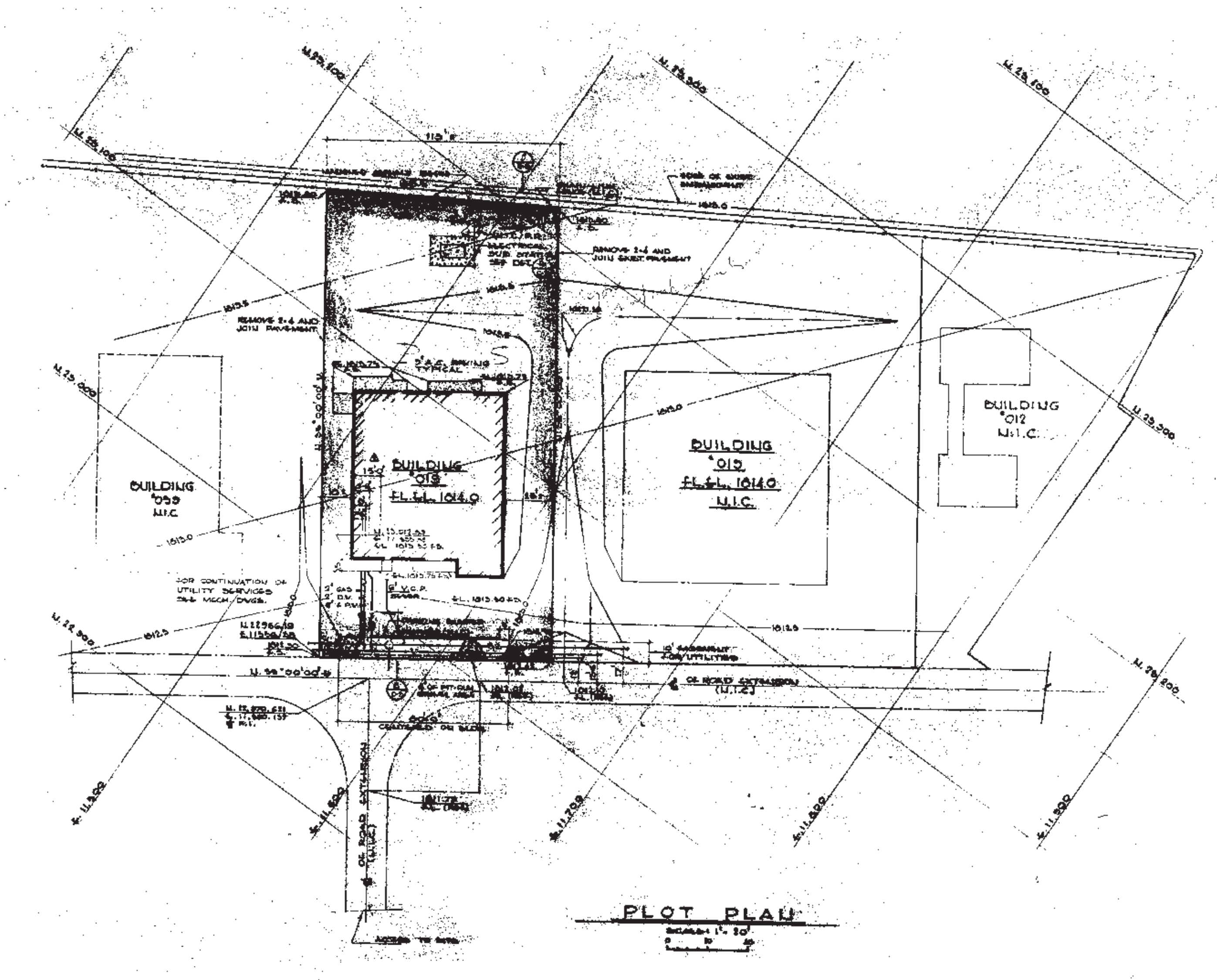
Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

FENCE

Figure 2.1.4b
Building 4019
Floor Plan



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Project:EP9038
Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

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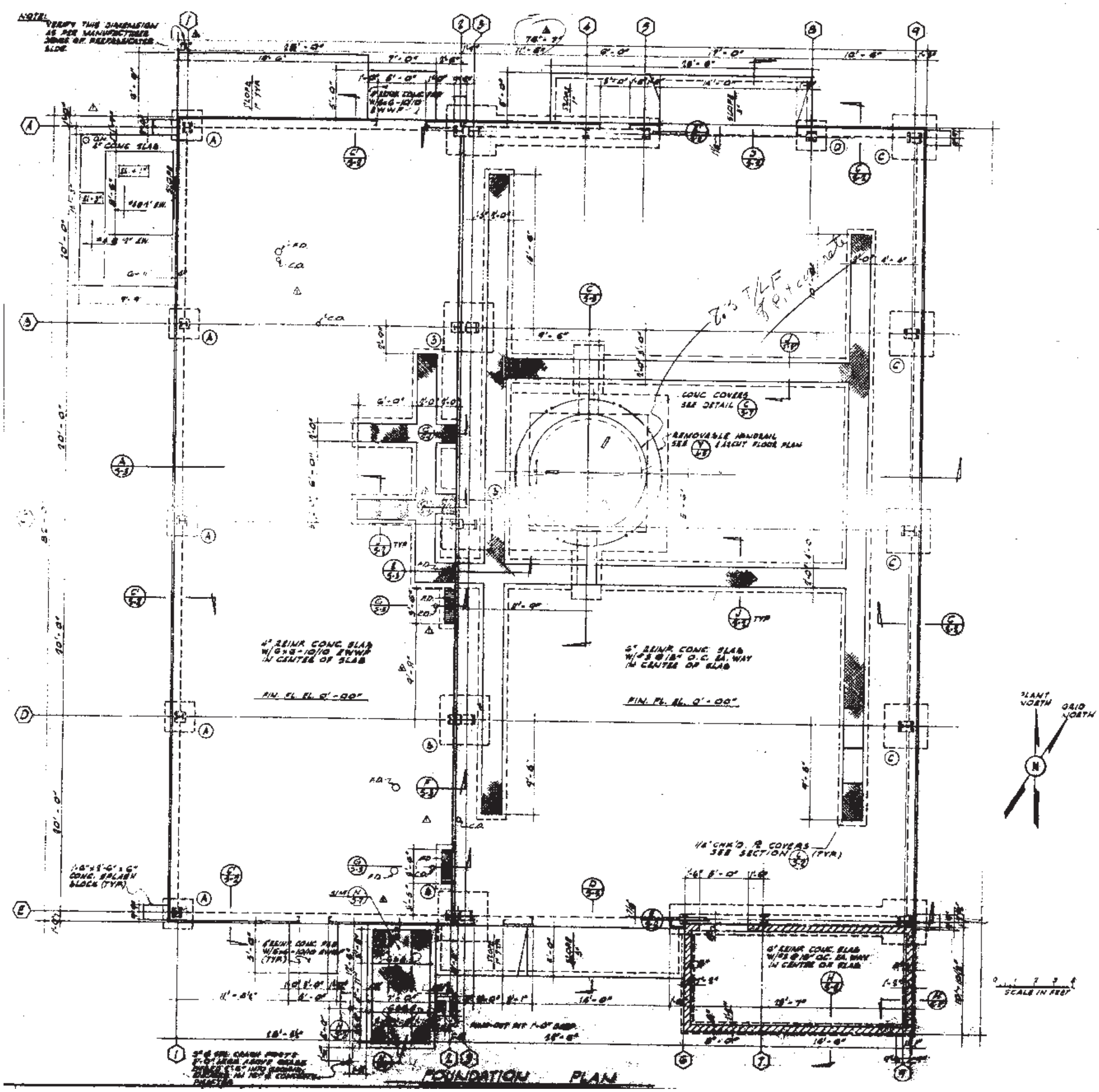
LEGEND:

6" V.C.P. SEWER
2" DOMESTIC WATER
2" GAS
6" V.C.P. SANITARY SEWER (N.I.C.)
6" WATER MAIN (N.I.C.)
4" GAS MAIN (N.I.C.)
REFERENCE BENCH MARK
NEW BUILDING
N.I.C. WORK
BLDG # 019 FLIGHT SYSTEMS PROTOTYPE NUCLEAR TEST FACILITY
P.P. POWER POLE
5" A.C. PAVING
F.S. FINISHED SURFACE
F.L. FLOW LINE
FINISHED SURFACE CONTOUR
EXIST. GRADES
6" FIRE PROTECTION WATER
CONCRETE

Figure 2.1.4c
Building 4019
Plot Plan



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Source: Boeing Company, 2008

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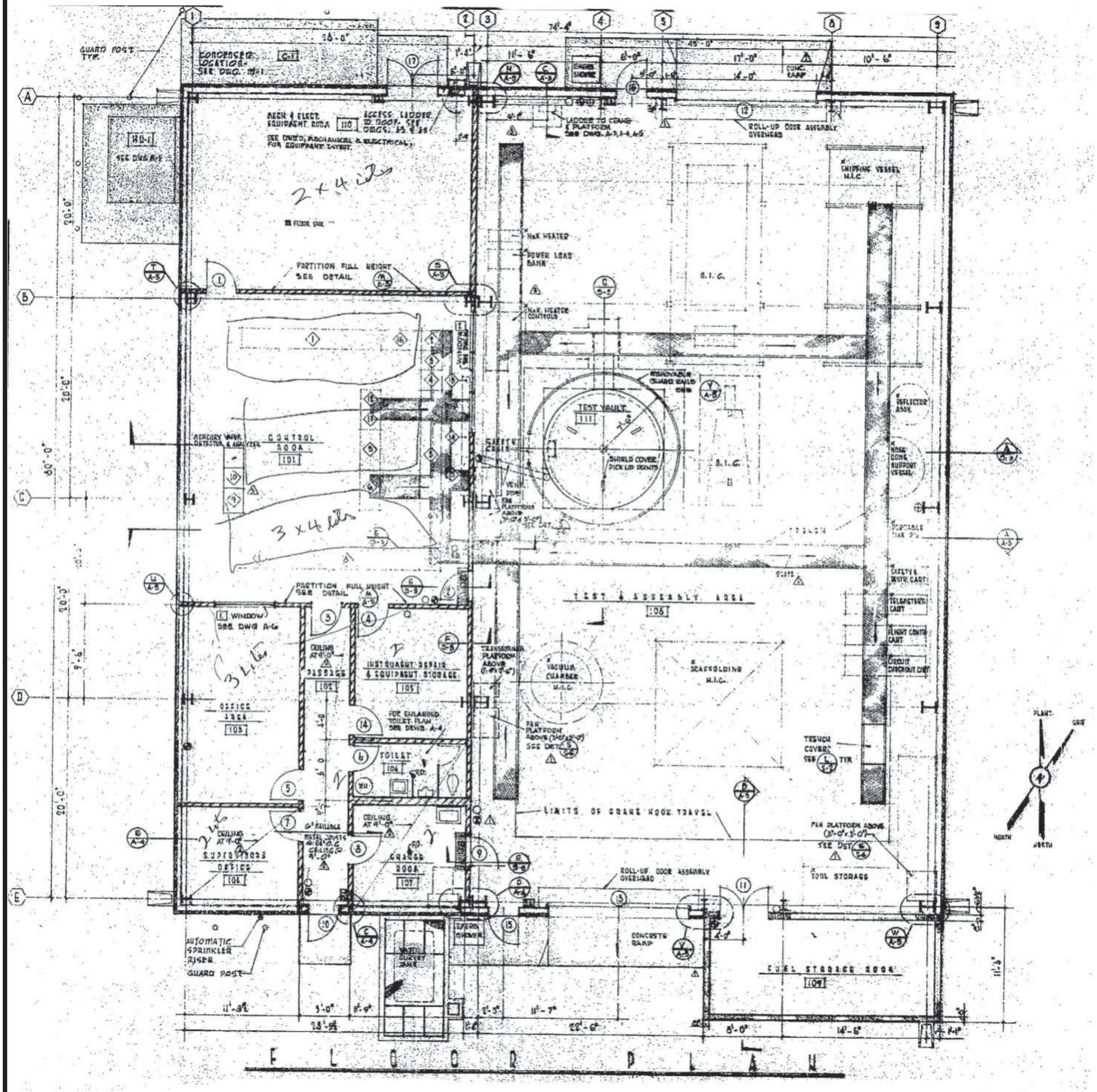
Figure 2.1.4d
Building 4019
Foundation Plan



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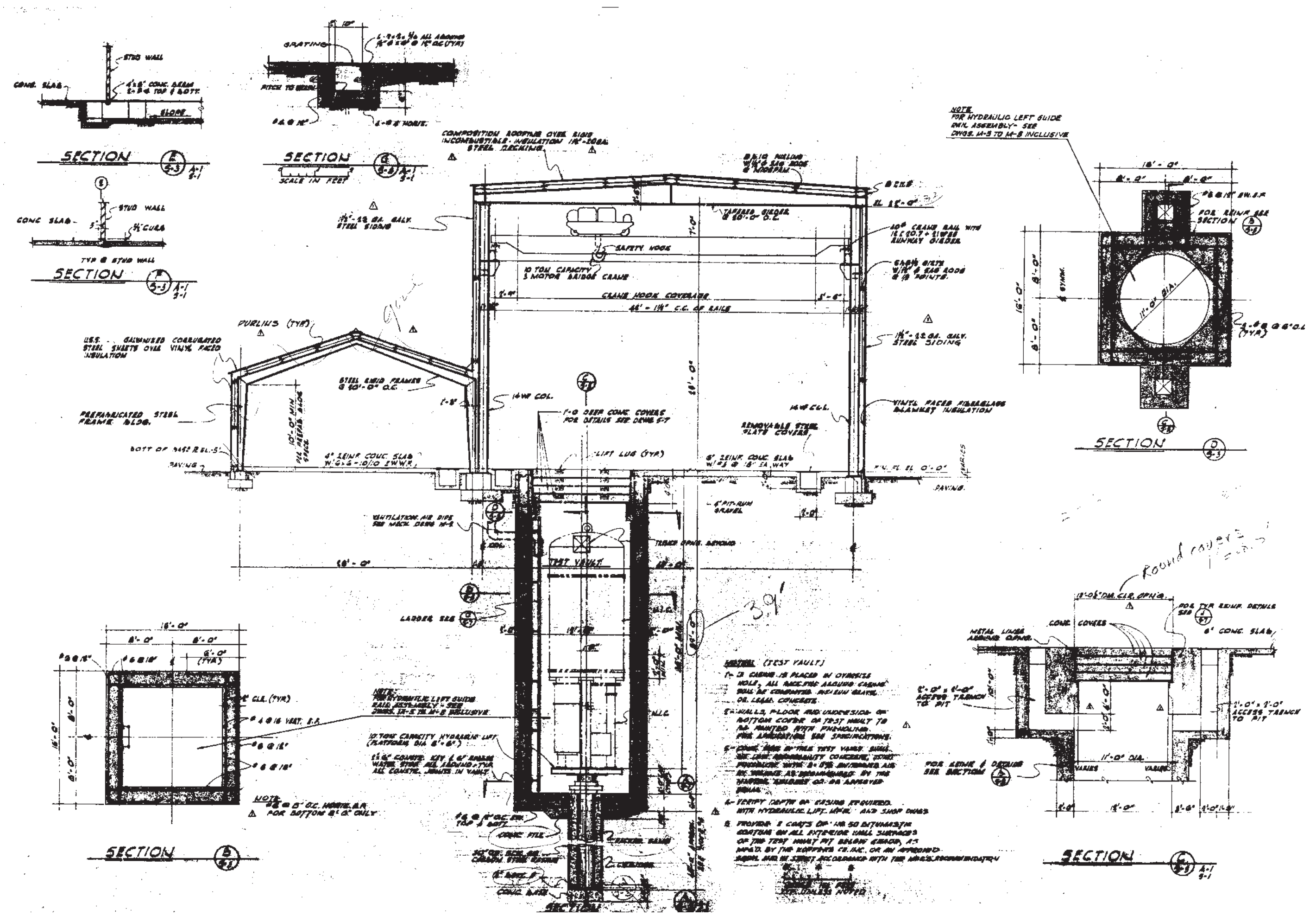
Project:EP9038
Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

GALV STL SIDING WALL WITH VINYL COVERED BLANKET INSULATION
METAL STUD & GYP. BRD WALL
CONCRETE BLOCK WALL
OUTLINE OF EQUIPMENT AREA
FIRE ALARM BOX
ROOM SYMBOL
EQUIPMENT SYMBOL
DOOR SYMBOL
DETAIL SYMBOL
SHEET SYMBOL
FIRE EXTINGUISHERS
PORTABLE DRY CHEMICAL
LIQUID METAL FIRE EXTINGUISHER
PORTABLE CO_2

Figure 2.1.4e
Building 4019
Floor Plan



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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

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Figure 2.1.4f
Building 4019
Structural Section Plan

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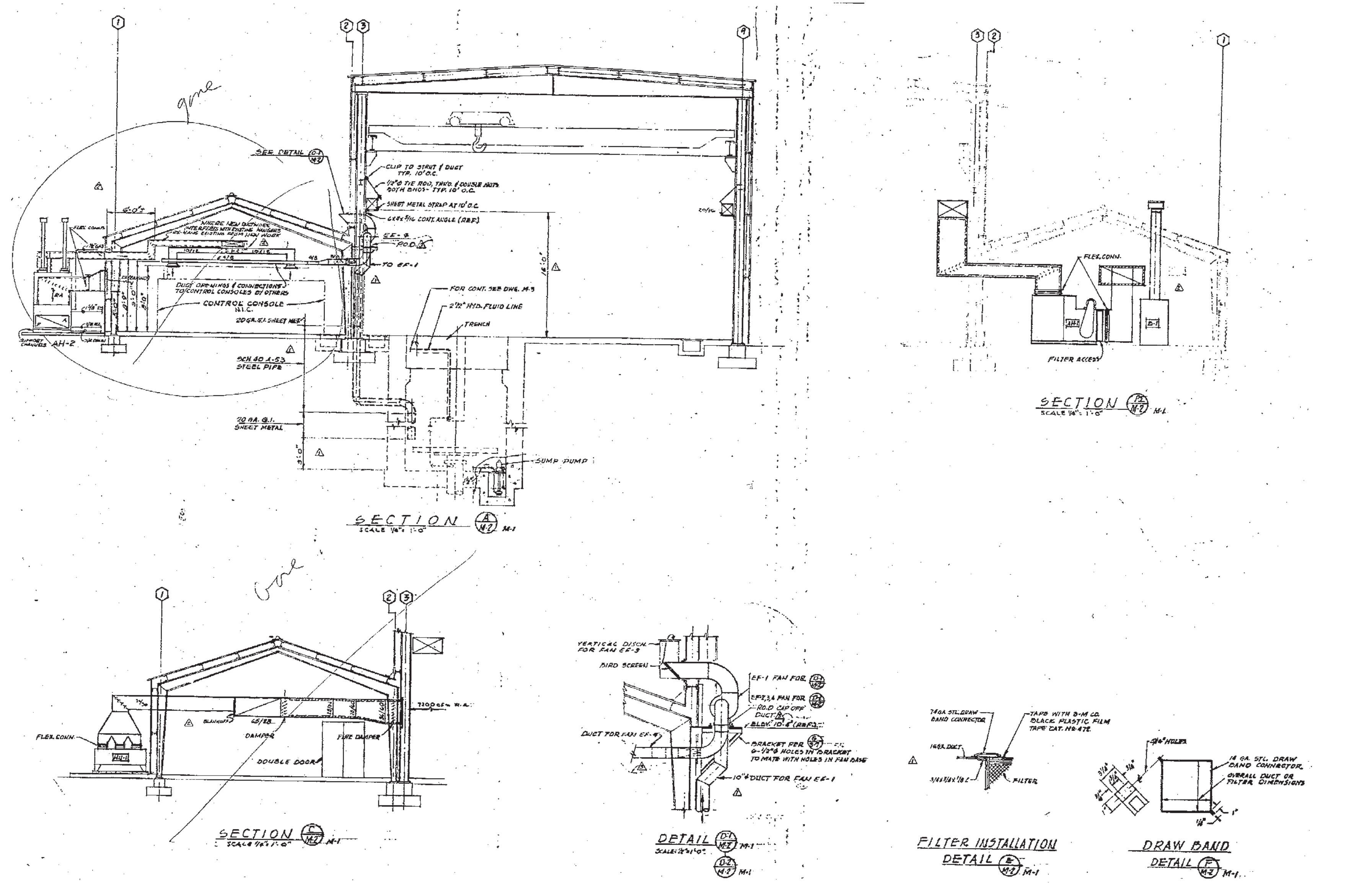

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Revised: 06/24/2010 RB
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.4g
Building 4019
Heat, Ventilation, and Air Conditioning Plan

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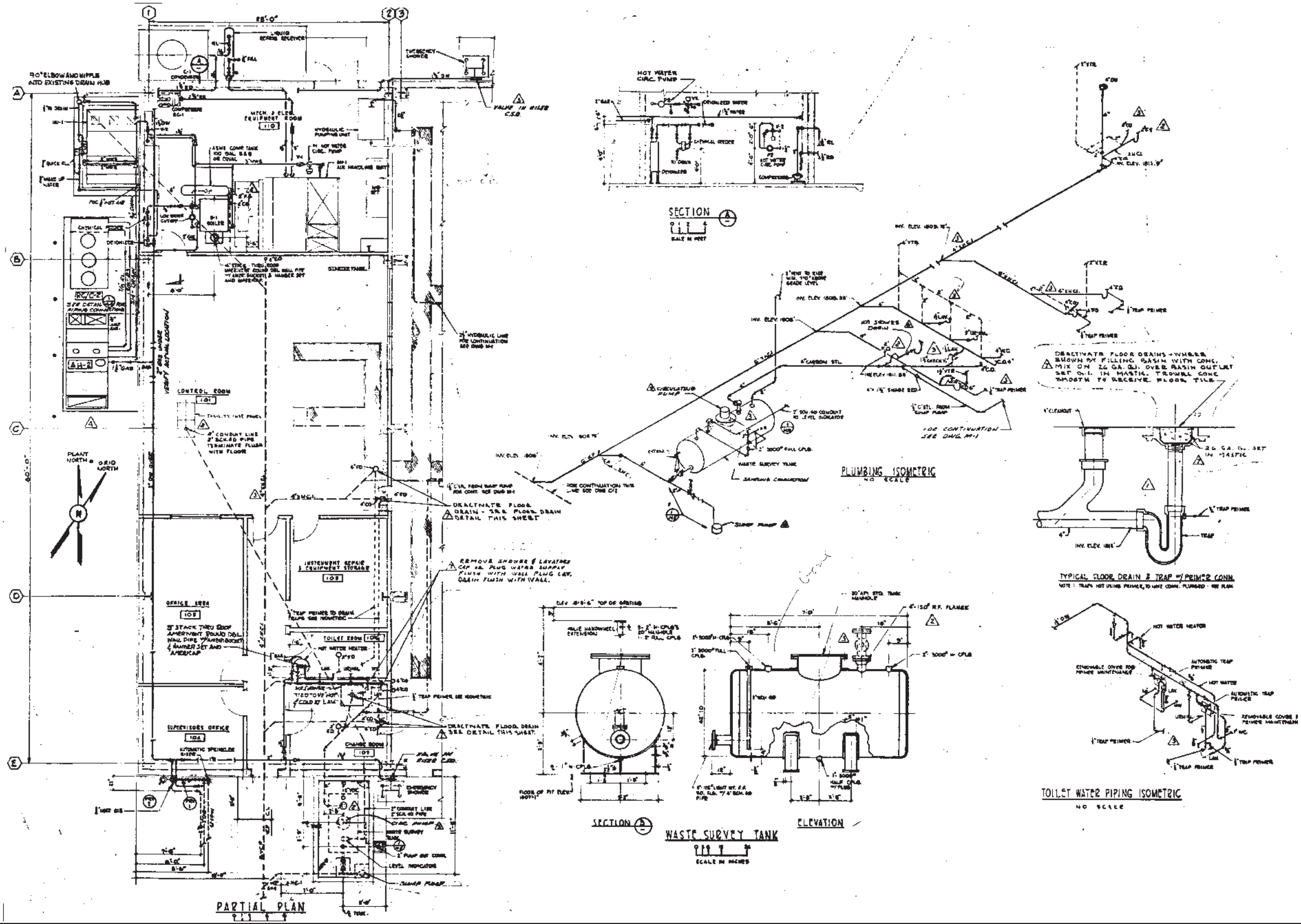

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Source: Boeing Company, 2008

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Figure 2.1.4h
Building 4019
Plumbing Plan

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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.5a
Building 4025
Site Photograph

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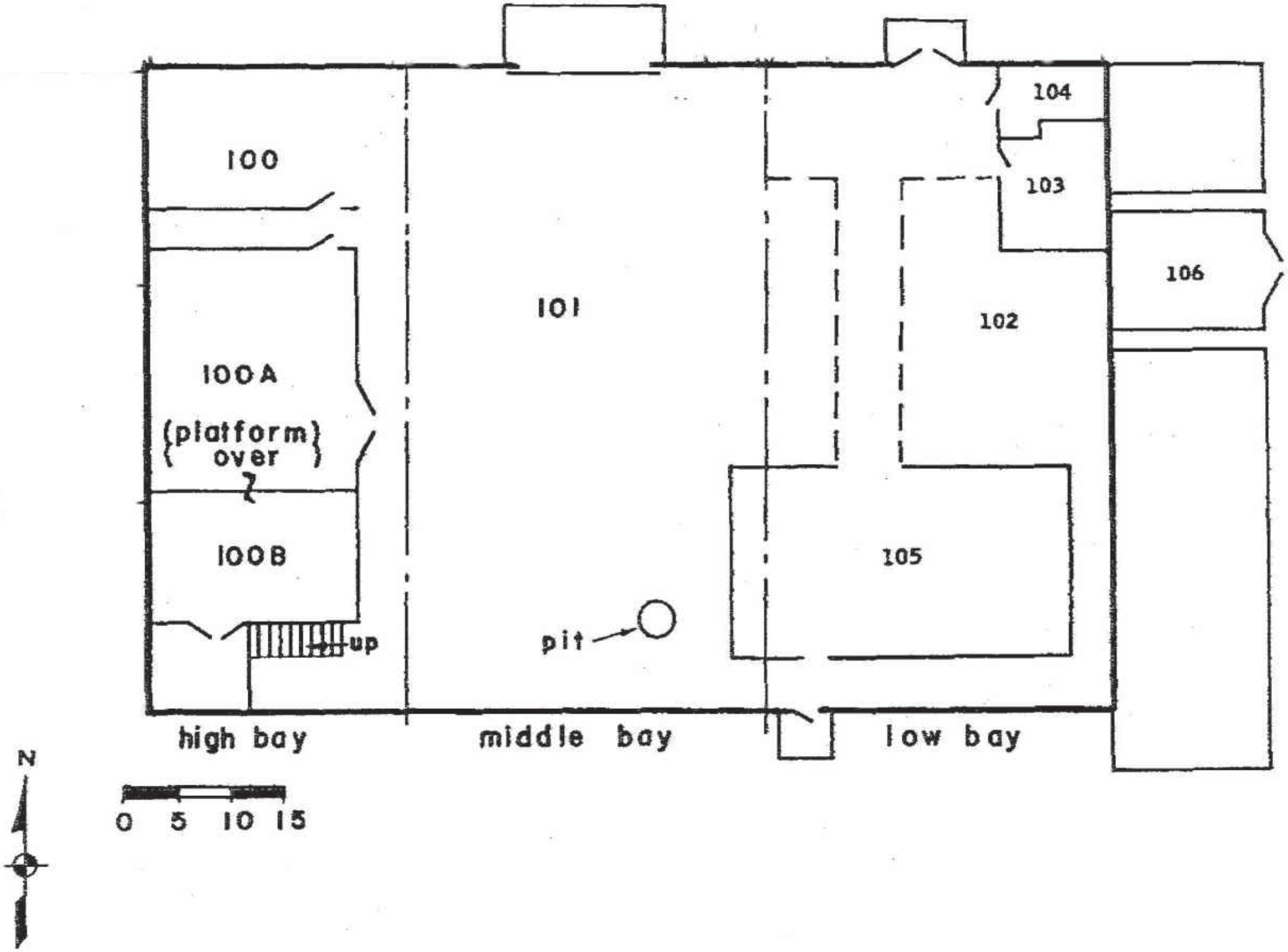

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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.5b
Building 4025
Floor Plan

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Project:EP9038
Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.6a
Building 4228
Site Photograph

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Project:EP9038
Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.7a
Building 4310
Site Photograph

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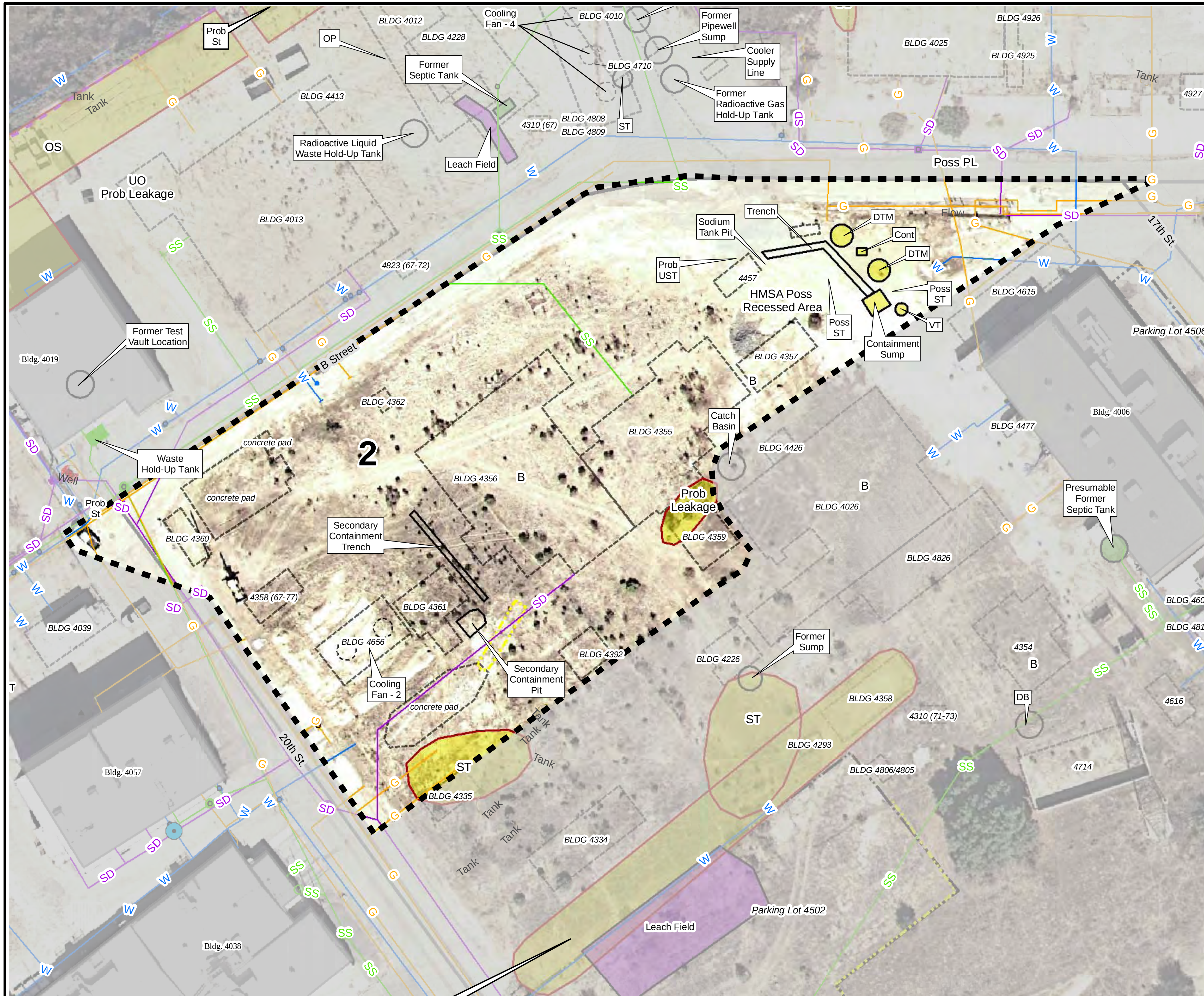
Historical Site Assessment
Final Technical Memorandum - HSA-5B

Figure 2.2
Area IV Subarea 5B-2
Santa Susana Field Laboratory

U.S. EPA Region 9



Legend

Subarea 5B-2 Boundary		B	Building
Primary Roads		CONT	Container
Secondary Roads		CR	Crates
Underground Storage Tank		DB	Debris
Unknown Tank Type		DG	Disturbed Ground
Sump		DTM	Dark Tone Material
Dry Well		EX	Excavation
Tank Footprint		FA	Fill Area
Above ground Storage Tank		GS	Ground Scar
Demolished Bldg.		HT	Horizontal Tank
Existing Bldg.		IM	Impoundment
Parking Lots		MTMM	Medium Toned Mounded Material
Drainage		OS	Open Storage
Drain		PA	Processing Area
Well		PL	Parking Lot
		POSS	Possible
		PROB	Probable
		S-T	Storage Tank
		SS	Smoke Stack
		ST	Storage
		UO	Unidentified Object
		VT	Vertical Tank
		WDA	Waste Disposal Area

Aerial Photo Features
- Aerial Photography Features
- Leach Field
- Other

Surface Water
- Intermittent Stream
- Permanent Stream
- Surface Water
- Lined Channel
- French Drain
- Drainage
- Leach Field
- Septic System

Utilities
- Channel
- Drain
- Drain
- Drainage Divide
- Gutter
- Tank
- Tank
- Vault
- Well
- Gas
- Storm Drain
- Sanitary Sewer
- Water

0 25 50 100
Scale In Feet

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Revised: 10/25/2010 TJ
Sorce: Boeing Company, 2008
CIRGIS, 2007

HGL HydroGeoLogic, Inc

Redacted

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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1a
Building 4355
Site Photograph

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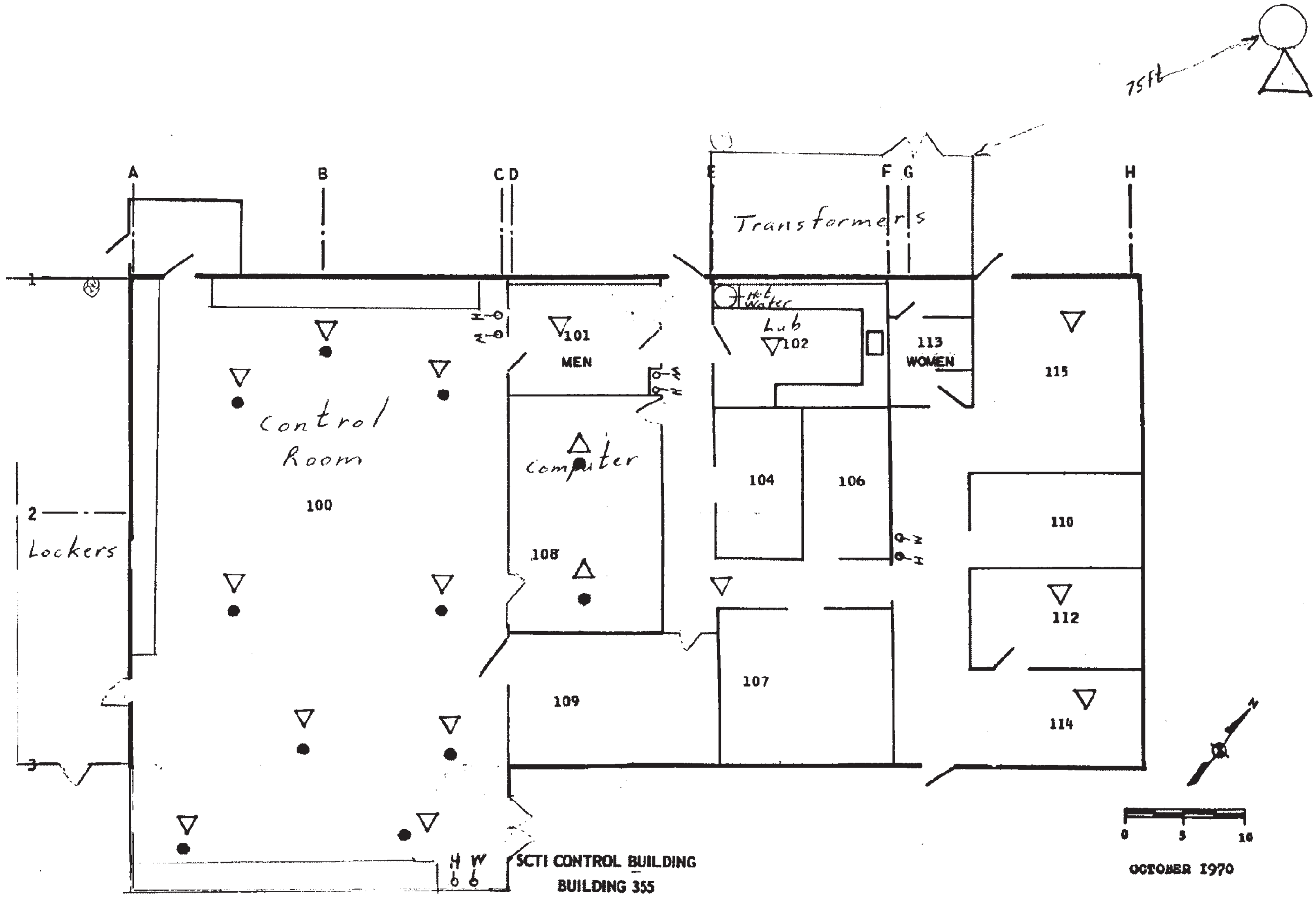

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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

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Figure 2.2.1b
Building 4355
Floor Plan

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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

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Figure 2.2.2a
Building 4356
Site Photograph

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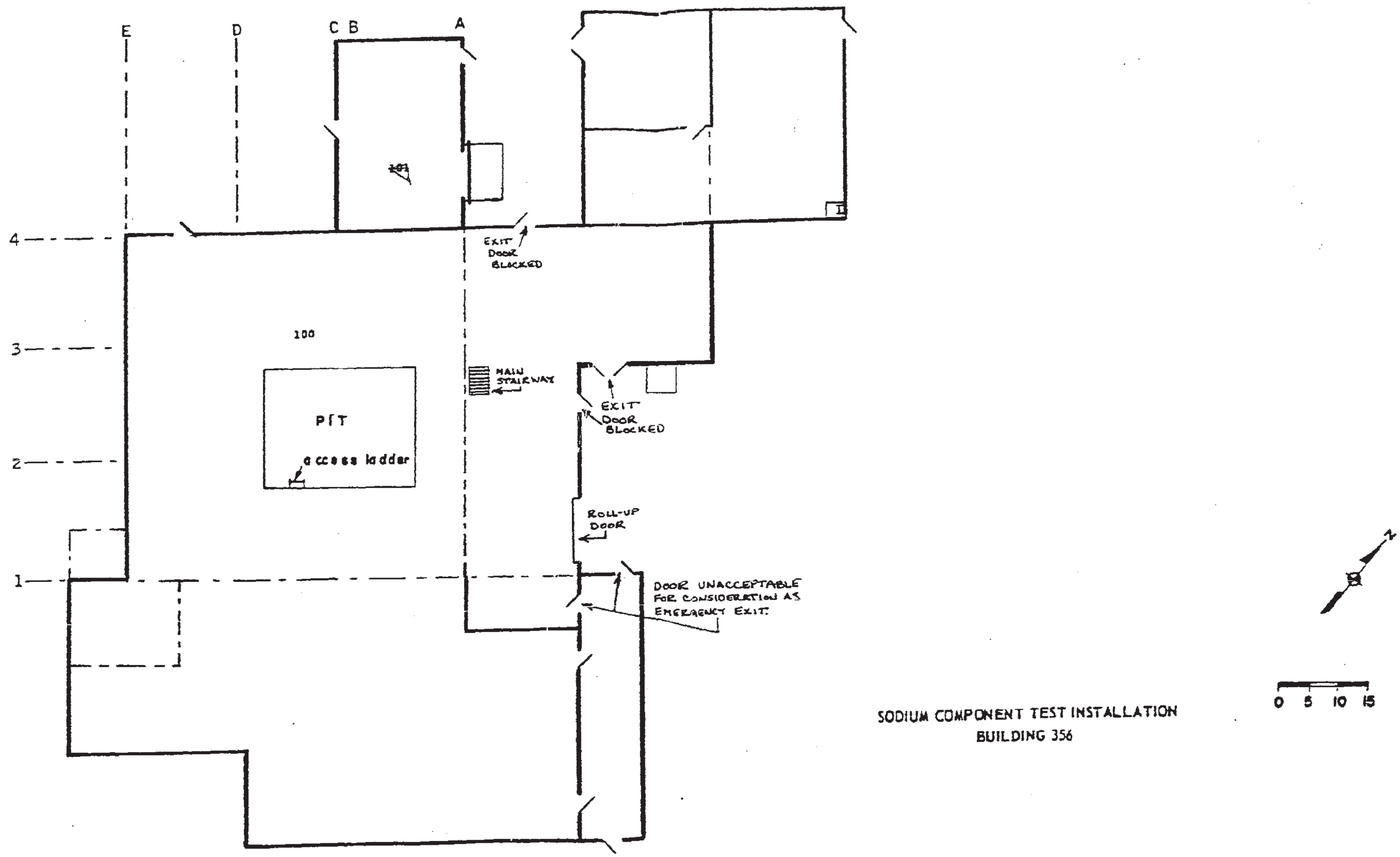

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Source: Boeing Company, 2008

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Figure 2.2.2b
Building 4356
Floor Plan

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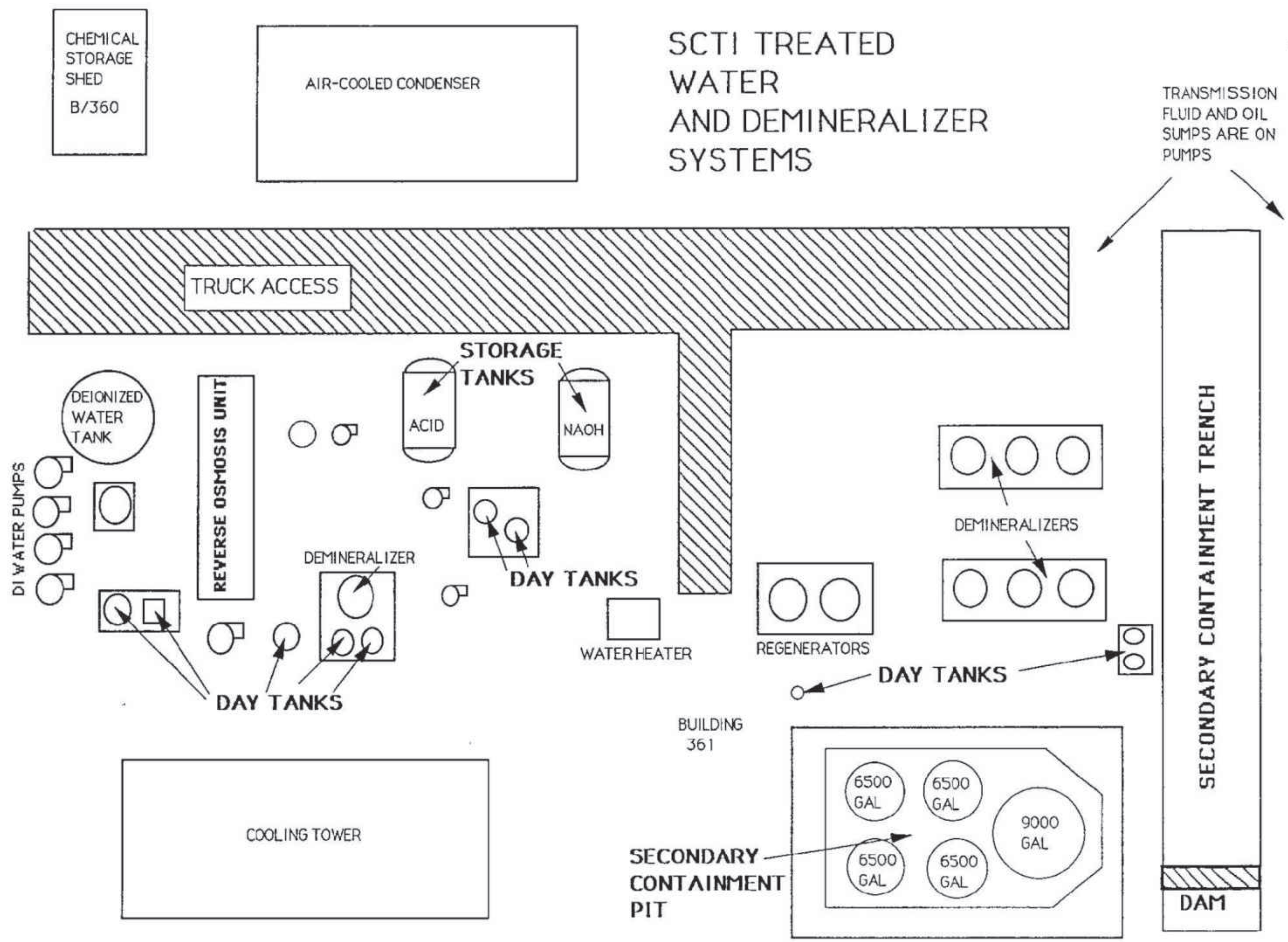

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Source: Boeing Company, 2008

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Figure 2.2.2c
Building 4356
West Yard
Area Plan

Redacted

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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

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Figure 2.2.3a
Building 4357
Site Photograph

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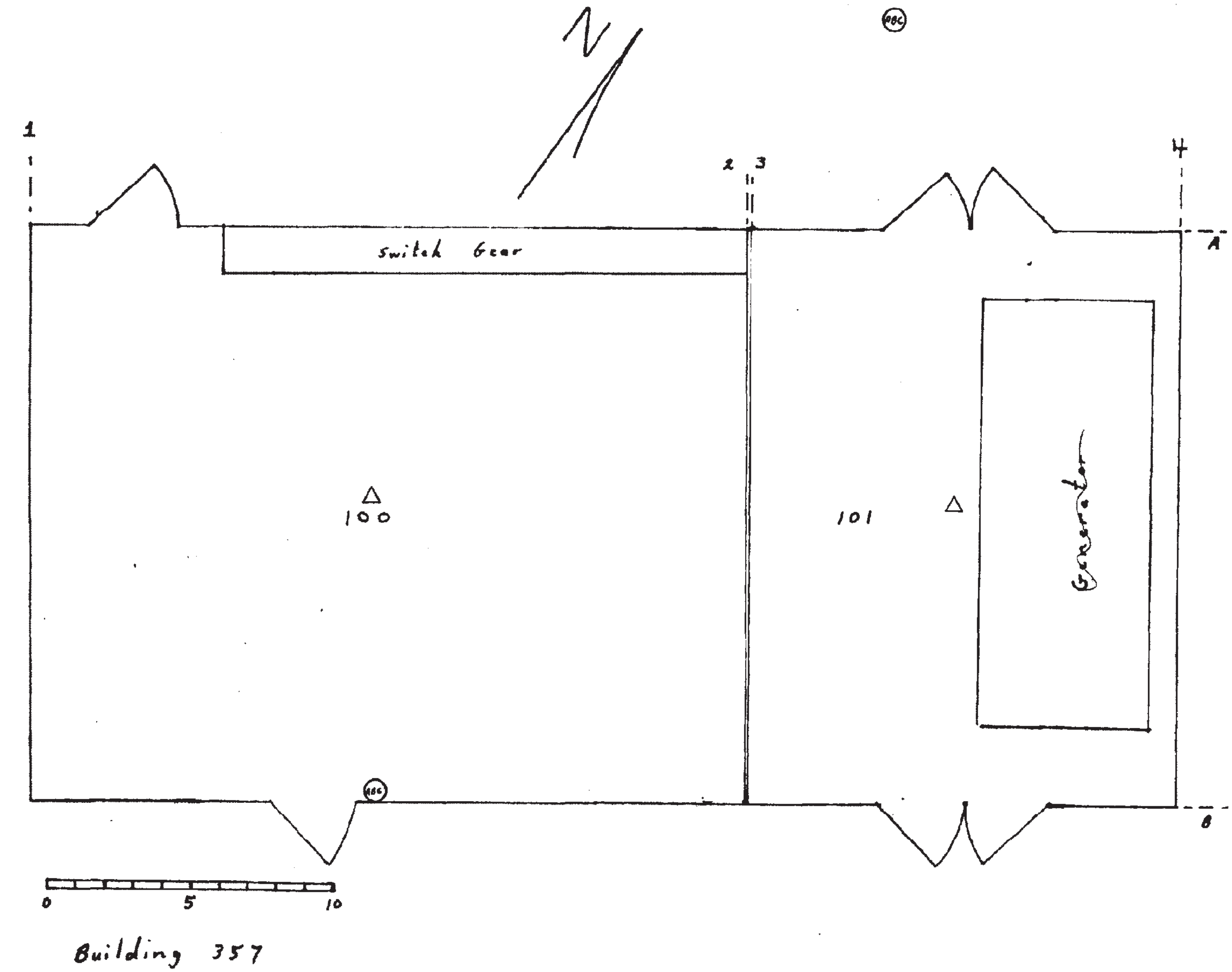

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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

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Figure 2.2.3b
Building 4357
Floor Plan

Redacted

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

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Figure 2.2.4a
Building 4358
Site Photograph

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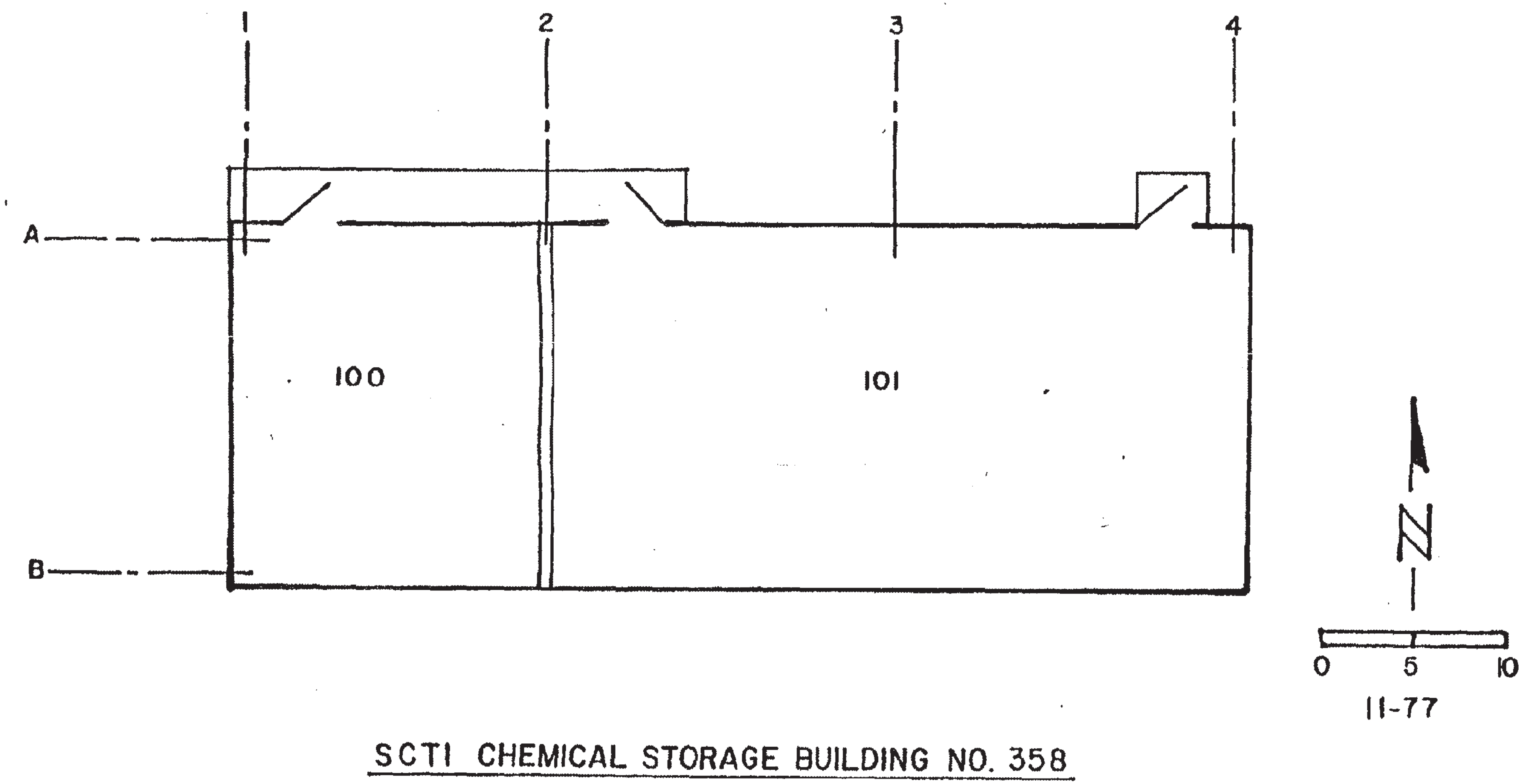

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.4b
Building 4358
Floor Plan

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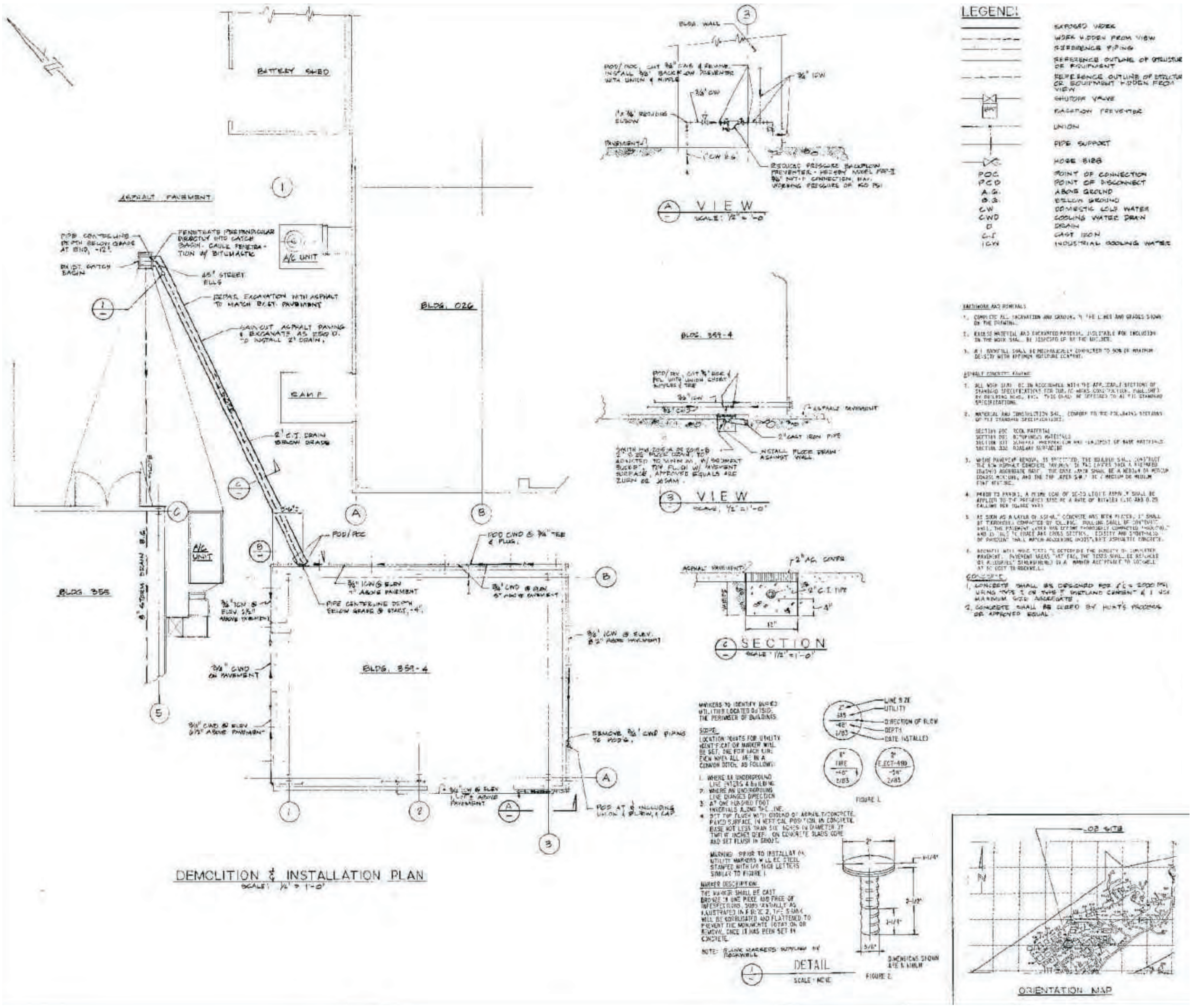
Revised: 09/08/2010 TJ
Source: Boeing Company, 2008*

U.S. EPA Region 9

**Figure 2.2.5a
Building 4359
Site Photograph**

Redacted



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Revised: 09/07/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.5b
Building 4359
Water/Sewer
Distribution

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Source: Boeing Company, 2008

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Figure 2.2.6a
Building 4360
Site Photograph

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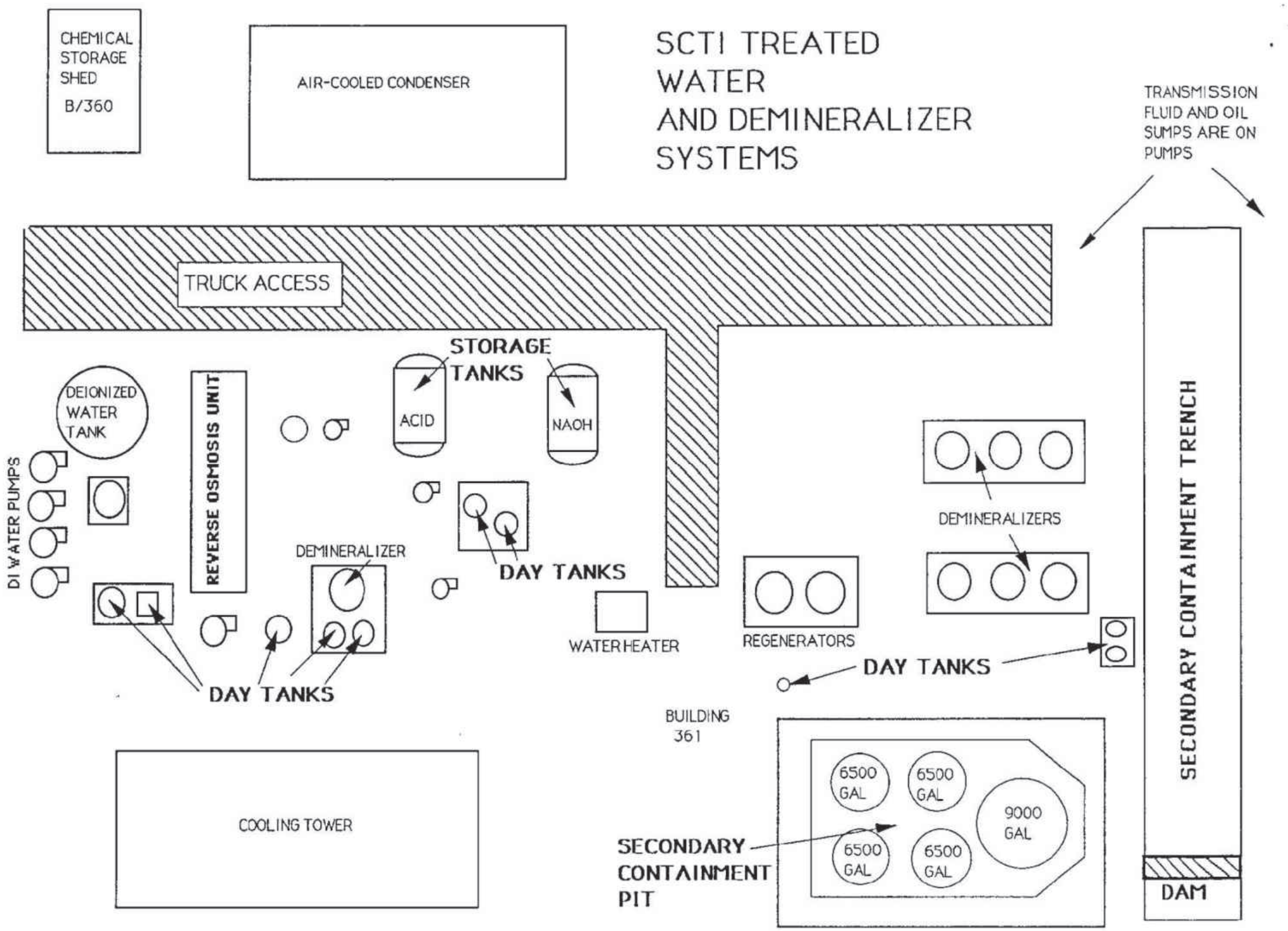

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Source: Boeing Company, 2008

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Figure2.2.6b
Building 4360
Area Plan

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.7a
Building 4361
Site Photograph

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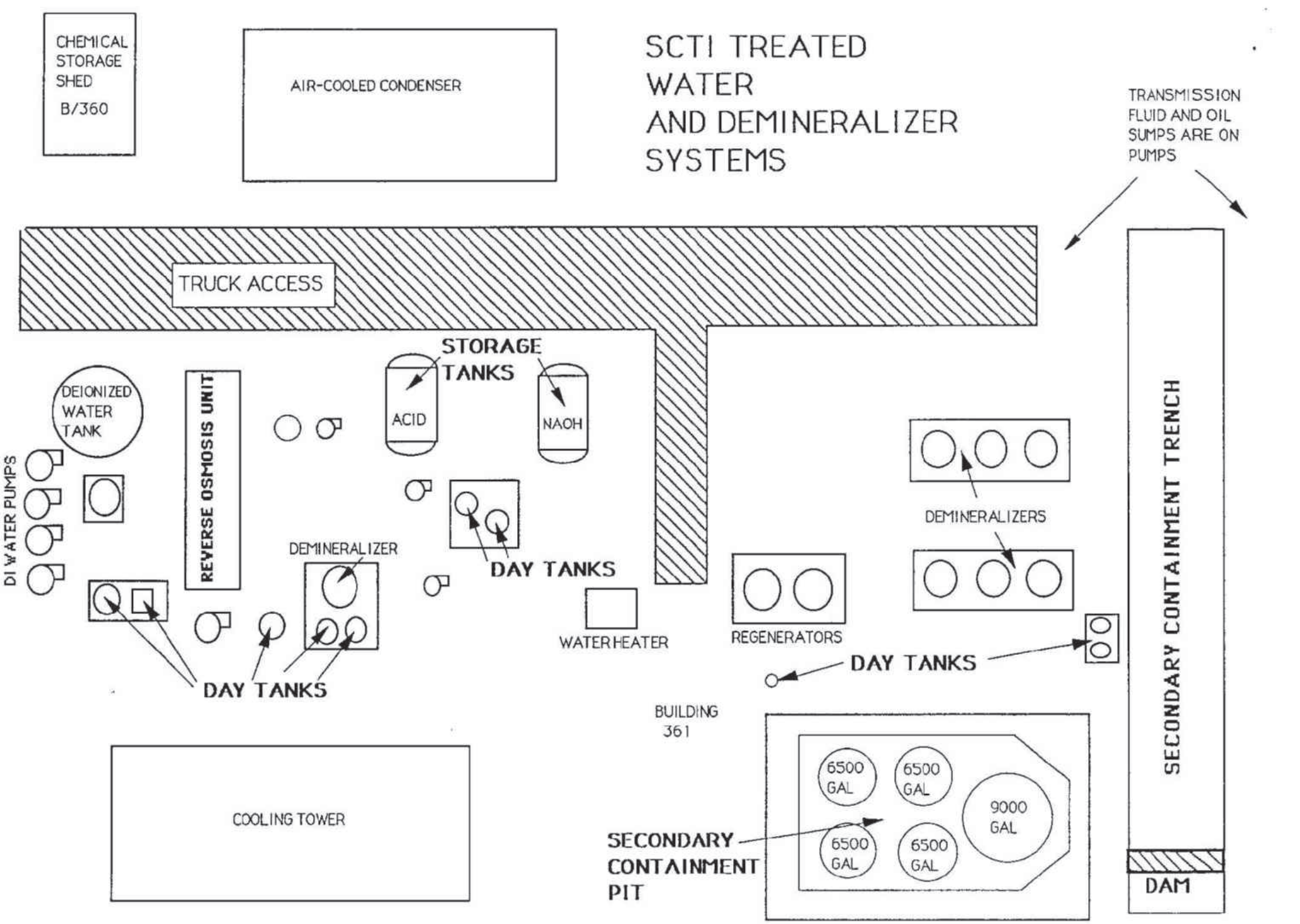

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.7b
Building 4361
Area Plan

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.8a
Building 4362
Site Photograph

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.9a
Building 4392
Site Photograph

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U.S. EPA Region 9

Figure 2.2.10a
Building 4457
Site Photograph

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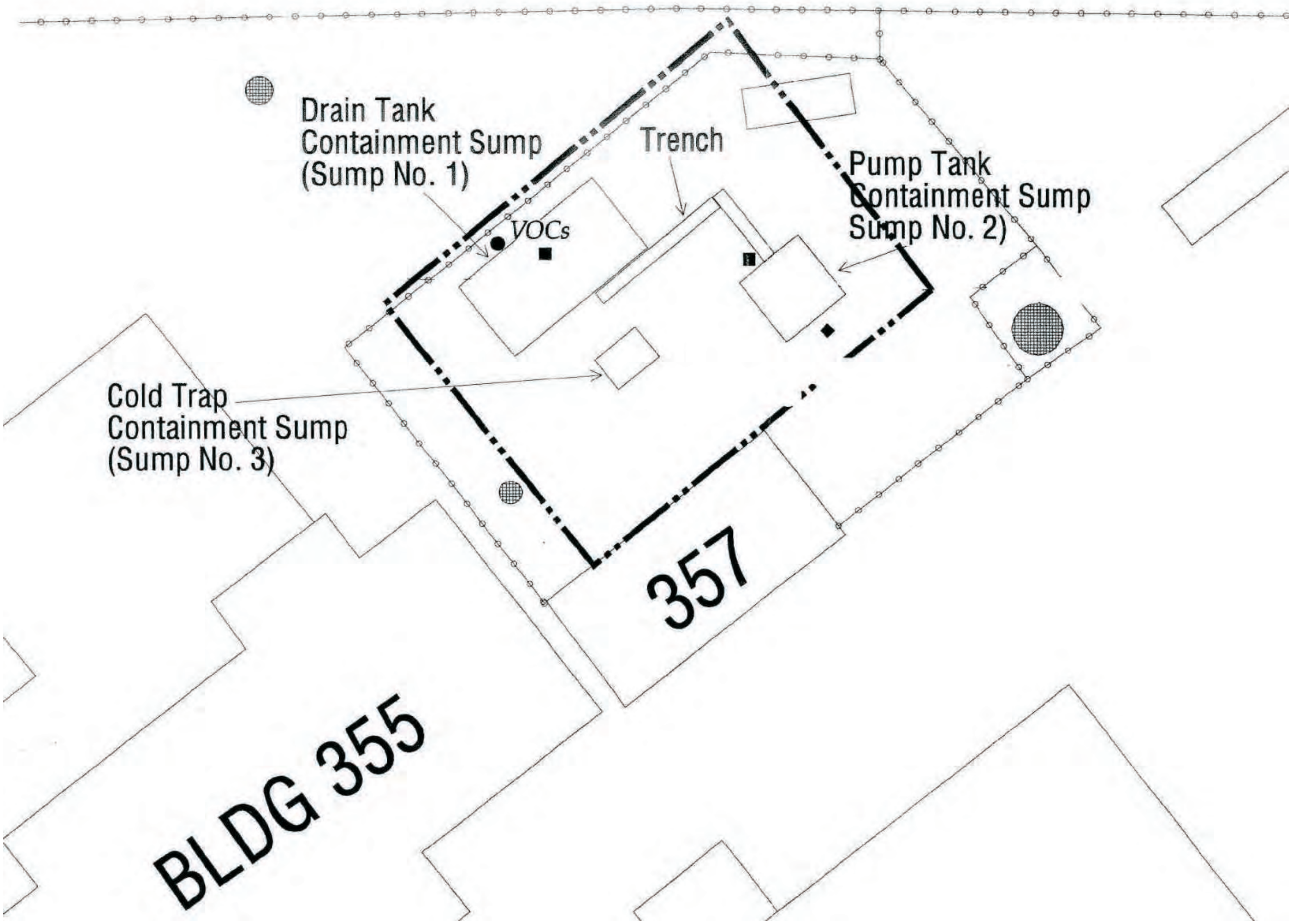

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Source: Boeing Company, 2008

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Figure 2.2.10b
Building 4457
Former HMSA Site

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.11a
Building 4478
Site Photograph

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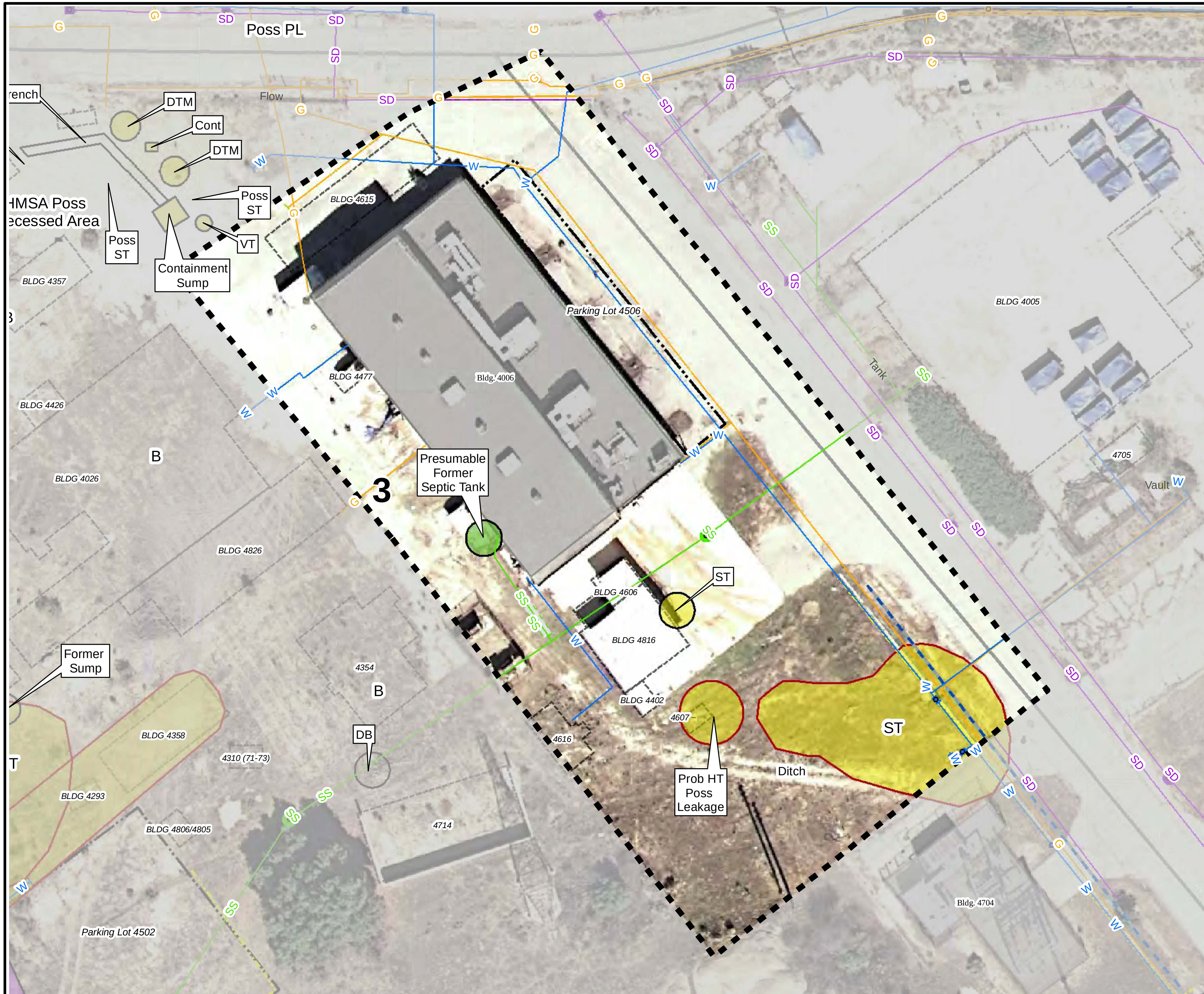
Figure 2.3
Area IV Subarea 5B-3
Santa Susana Field Laboratory

U.S. EPA Region 9



Legend

- Subarea 5B-3 Boundary
- Primary Roads
- Secondary Roads
- Underground Storage Tank
- Unknown Tank Type
- Sump
- Dry Well
- Tank Footprint
- Above ground Storage Tank
- Demolished Bldg.
- Existing Bldg.
- Parking Lots
- Drainage
- Drain
- Well

Aerial Photo Features

- Aerial Photography Features
- Leach Field
- Other

Surface Water

- Intermittent Stream
- Permanent Stream
- Surface Water
- Lined Channel
- French Drain
- Drainage
- Leach Field
- Septic System

Utilities

- Channel
- Drain
- Drain
- Drainage Divide
- Gutter
- Tank
- Tank
- Vault
- Well
- Gas
- Storm Drain
- Sanitary Sewer
- Water

B	Building
CONT	Container
CR	Crates
DB	Debris
DG	Disturbed Ground
DTM	Dark Tone Material
EX	Excavation
FA	Fill Area
GS	Ground Scar
HT	Horizontal Tank
IM	Impoundment
MTMM	Medium Toned Mounded Material
OS	Open Storage
PA	Processing Area
PL	Parking Lot
POSS	Possible
PROB	Probable
S-T	Storage Tank
SS	Smoke Stack
ST	Storage
UO	Unidentified Object
VT	Vertical Tank
WDA	Waste Disposal Area

N

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Scale In Feet

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Revised: 10/25/2010 TJ
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CIRGIS, 2007

HGL HydroGeoLogic, Inc

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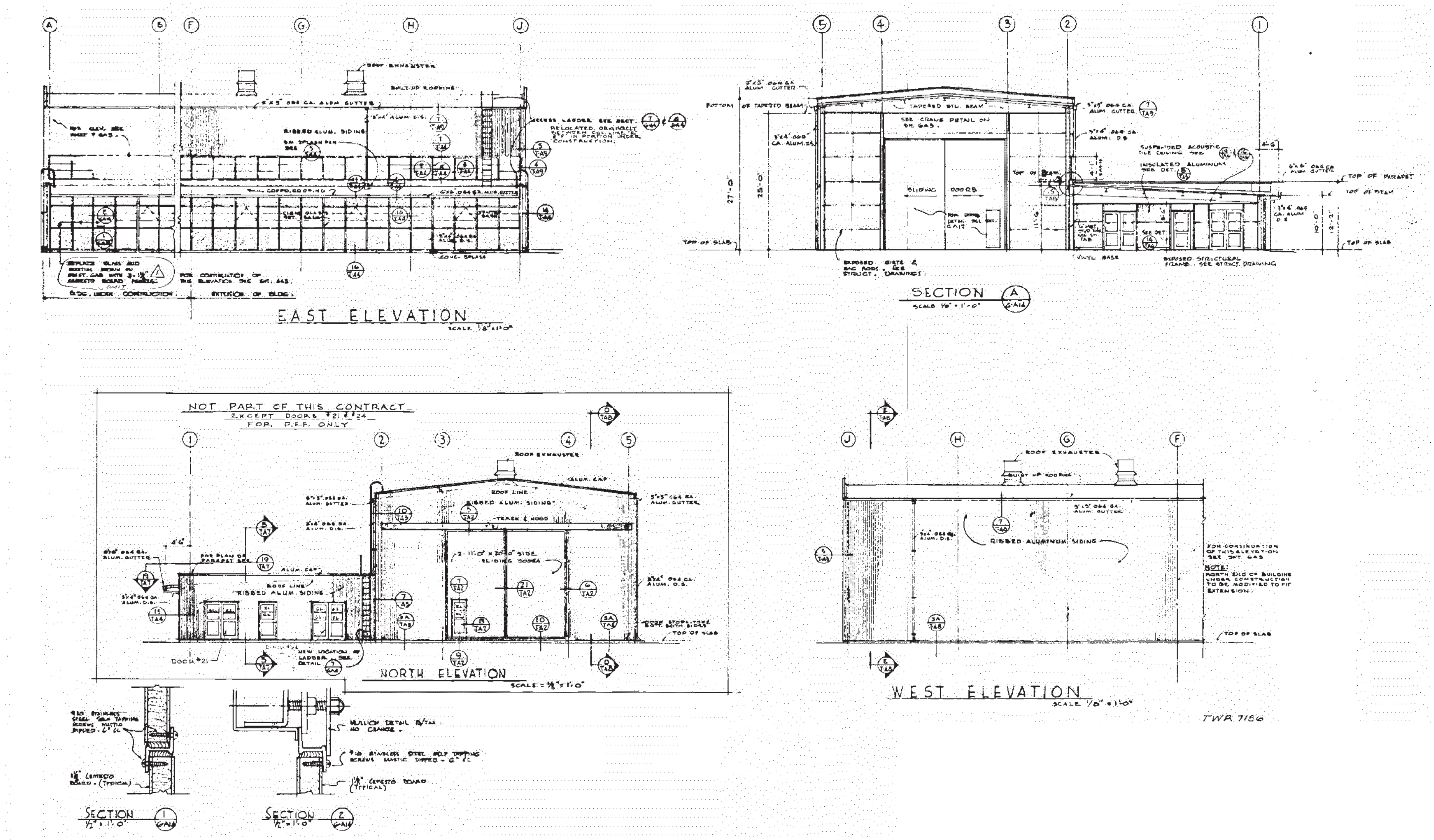
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.1a
Building 4006
Site Photograph



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U.S. EPA Region 9

Figure 2.3.1b
Building 4006
Elevations and Section

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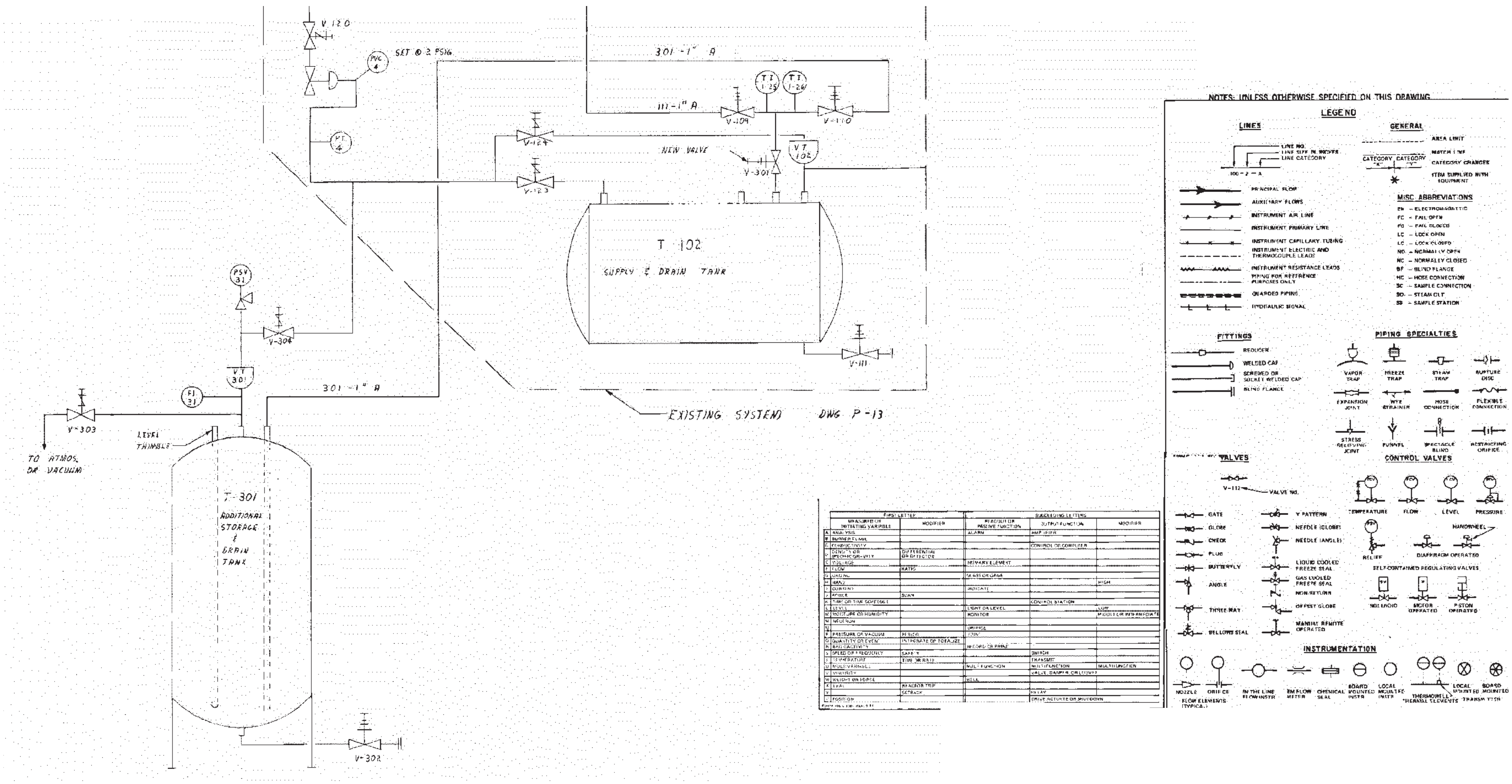

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.1c
Building 4006
Plumbing and Tanks

Redacted

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.2a
Building 4402
Site Photograph

Y:/Santa_Susana/EP9038/TM/HSA_5B
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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.3a
Building 4506
Site Photograph

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Project:EP9038
Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.4a
Building 4606
Site Photograph

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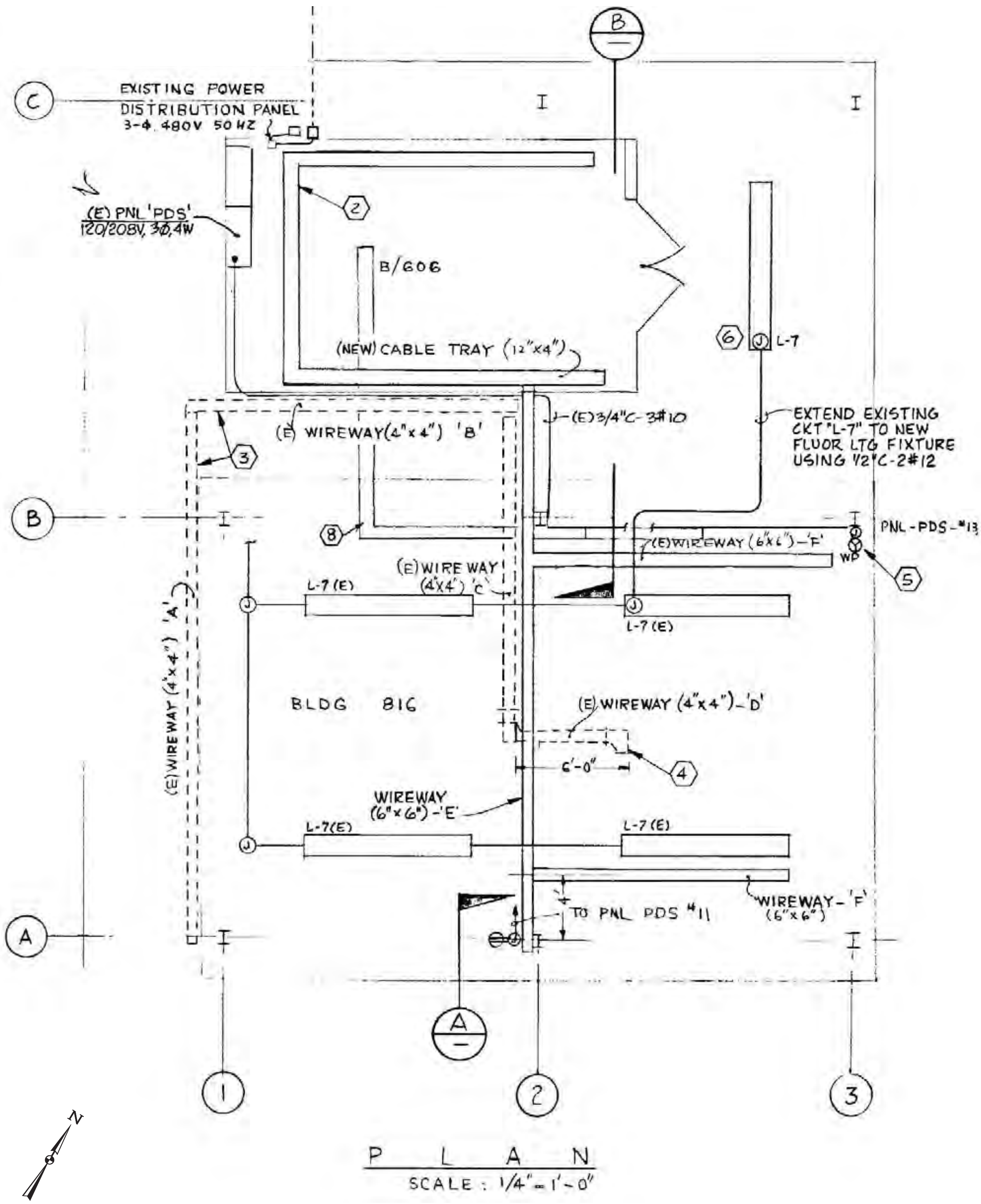

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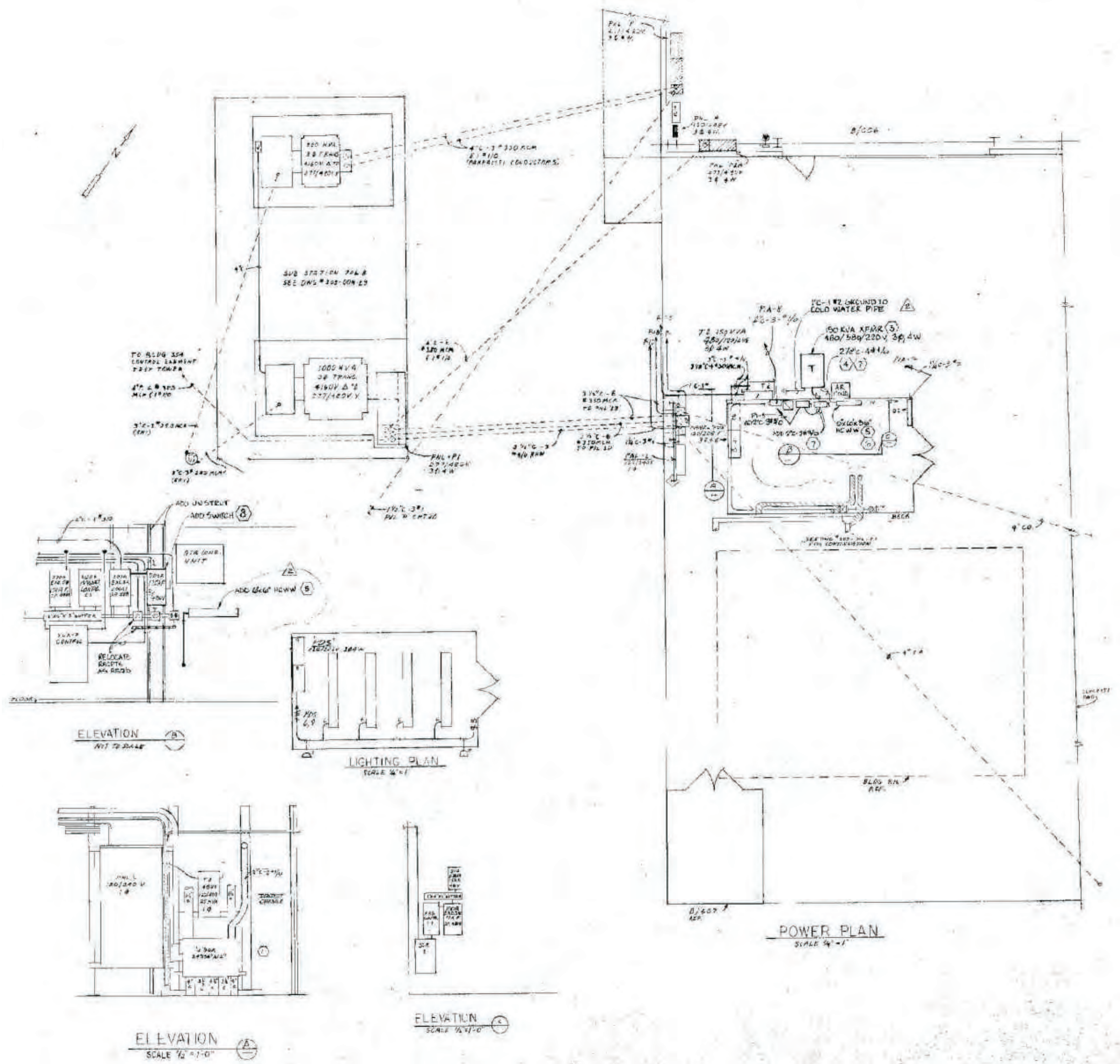
U.S. EPA Region 9

Figure 2.3.4b
Building 4606
Recombiner Wireway



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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.4c
Building 4606
Yard Area

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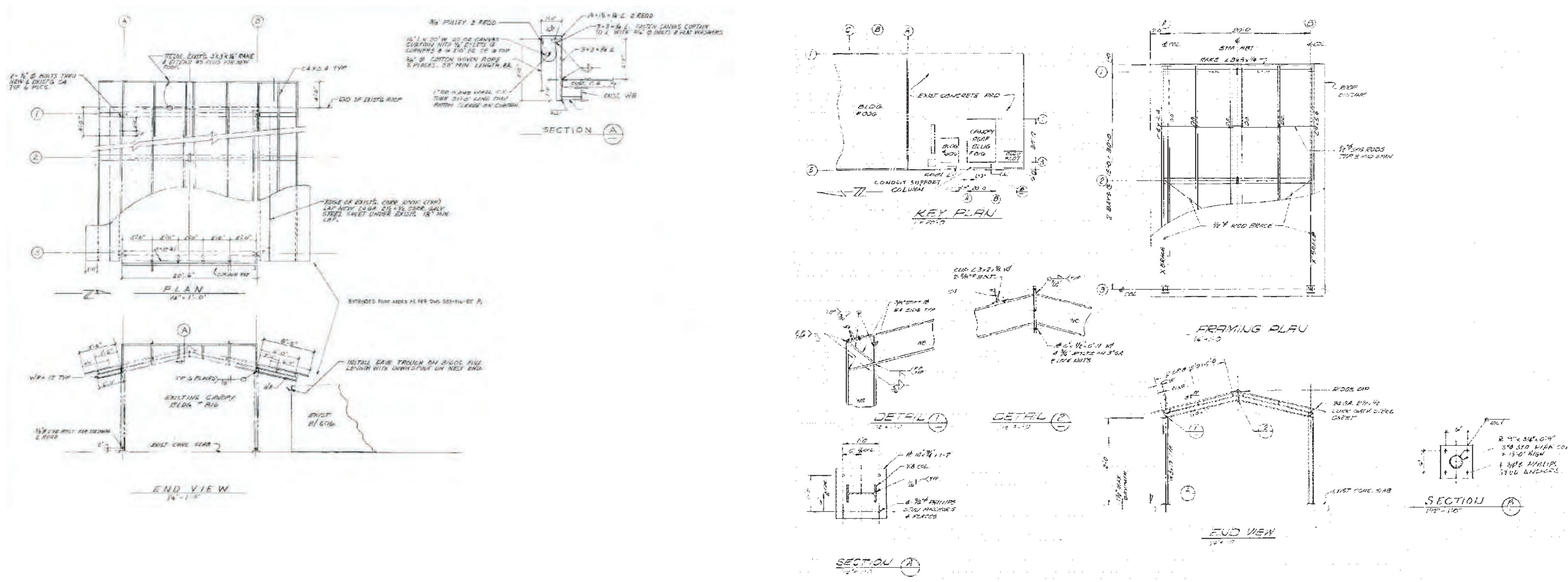

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U.S. EPA Region 9

Figure 2.3.4d
Building 4816
Hydrogen Recombiner Facility

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.5a
Building 4607
Site Photograph

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.6a
Building 4615
Site Photograph

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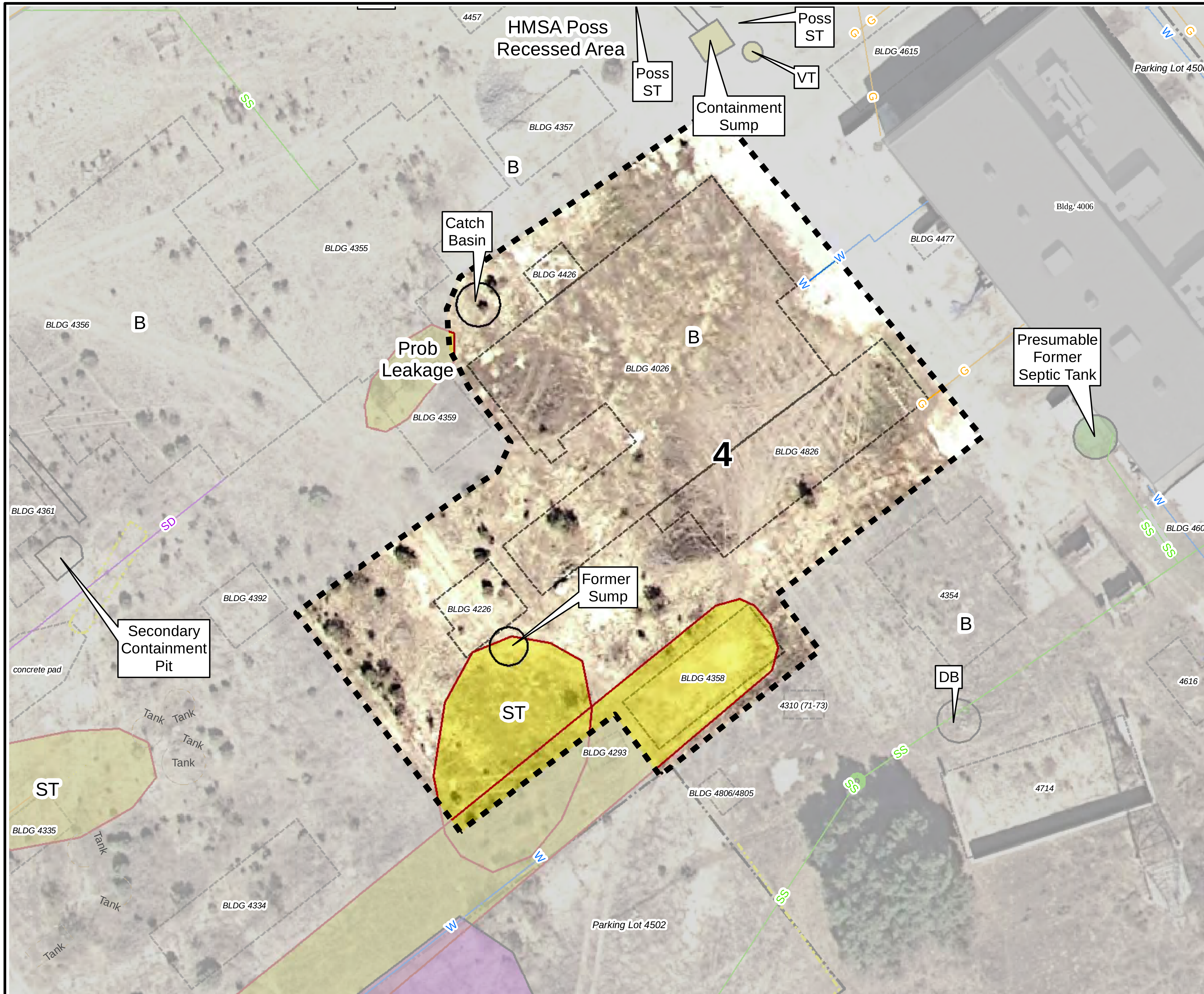
Figure 2.4
Area IV Subarea 5B-4
Santa Susana Field Laboratory

U.S. EPA Region 9



Legend

- Subarea 5B-4 Boundary
- Primary Roads
- Secondary Roads
- Underground Storage Tank
- Unknown Tank Type
- Sump
- Dry Well
- Tank Footprint
- Above ground Storage Tank
- Demolished Bldg.
- Existing Bldg.
- Parking Lots
- Drainage
- Drain
- Well

Aerial Photo Features

- Aerial Photography Features
- Leach Field
- Other

Surface Water

- Intermittent Stream
- Permanent Stream
- Surface Water
- Lined Channel
- French Drain
- Drainage
- Leach Field
- Septic System

Utilities

- Channel
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- Drain
- Drainage Divide
- Gutter
- Tank
- Tank
- Vault
- Well
- Gas
- Storm Drain
- Sanitary Sewer
- Water

B	Building
CONT	Container
CR	Crates
DB	Debris
DG	Disturbed Ground
DTM	Dark Tone Material
EX	Excavation
FA	Fill Area
GS	Ground Scar
HT	Horizontal Tank
IM	Impoundment
MTMM	Medium Toned Mounded Material
OS	Open Storage
PA	Processing Area
PL	Parking Lot
POSS	Possible
PROB	Probable
S-T	Storage Tank
SS	Smoke Stack
ST	Storage
UO	Unidentified Object
VT	Vertical Tank
WDA	Waste Disposal Area

N

0 25 50 100
Scale In Feet

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Created: TJansen
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Sorce: Boeing Company, 2008
CIRGIS, 2007

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.4.1a
Building 4026
Site Photograph

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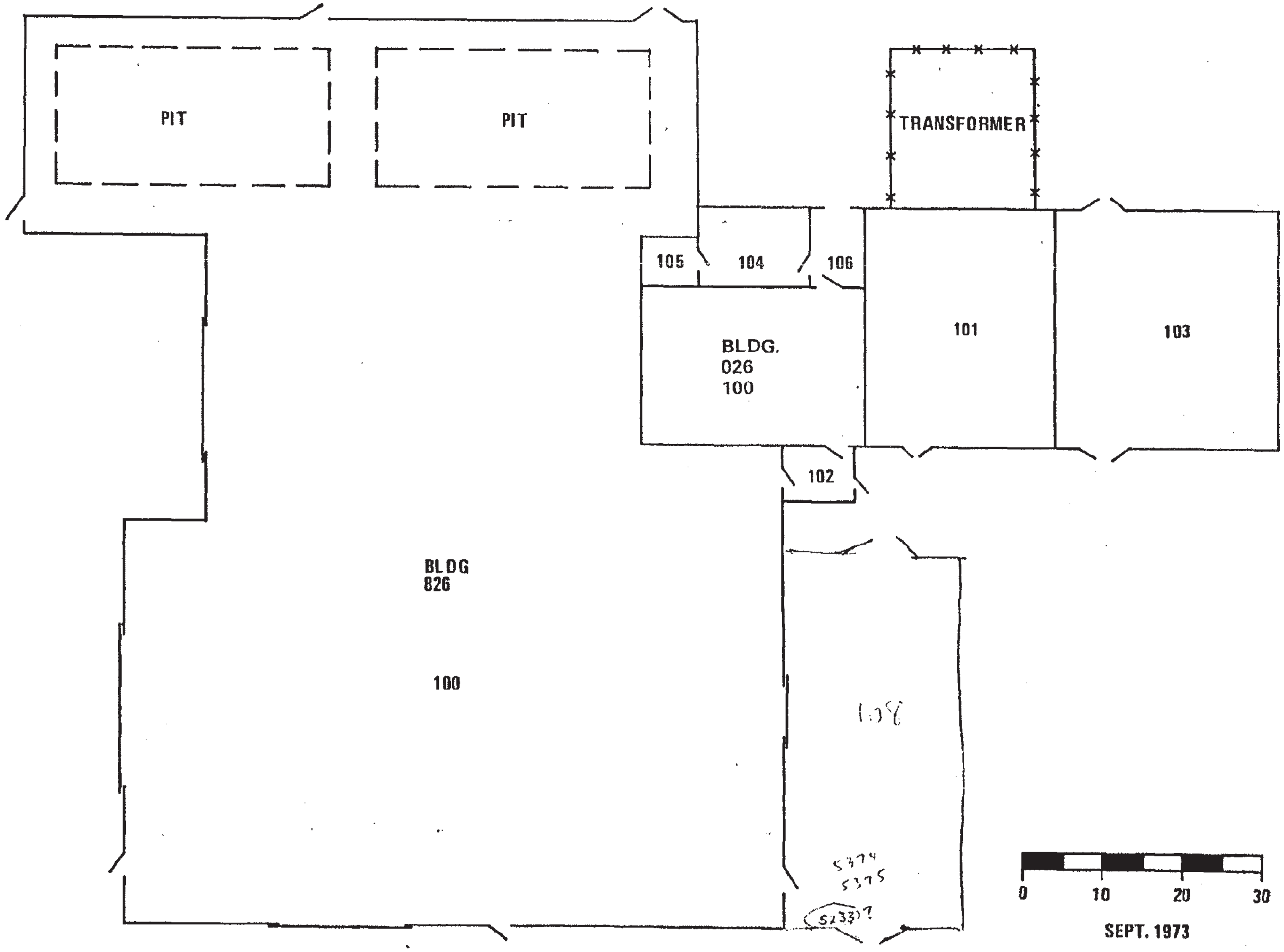

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.4.1b
SCTL
Floor Plan

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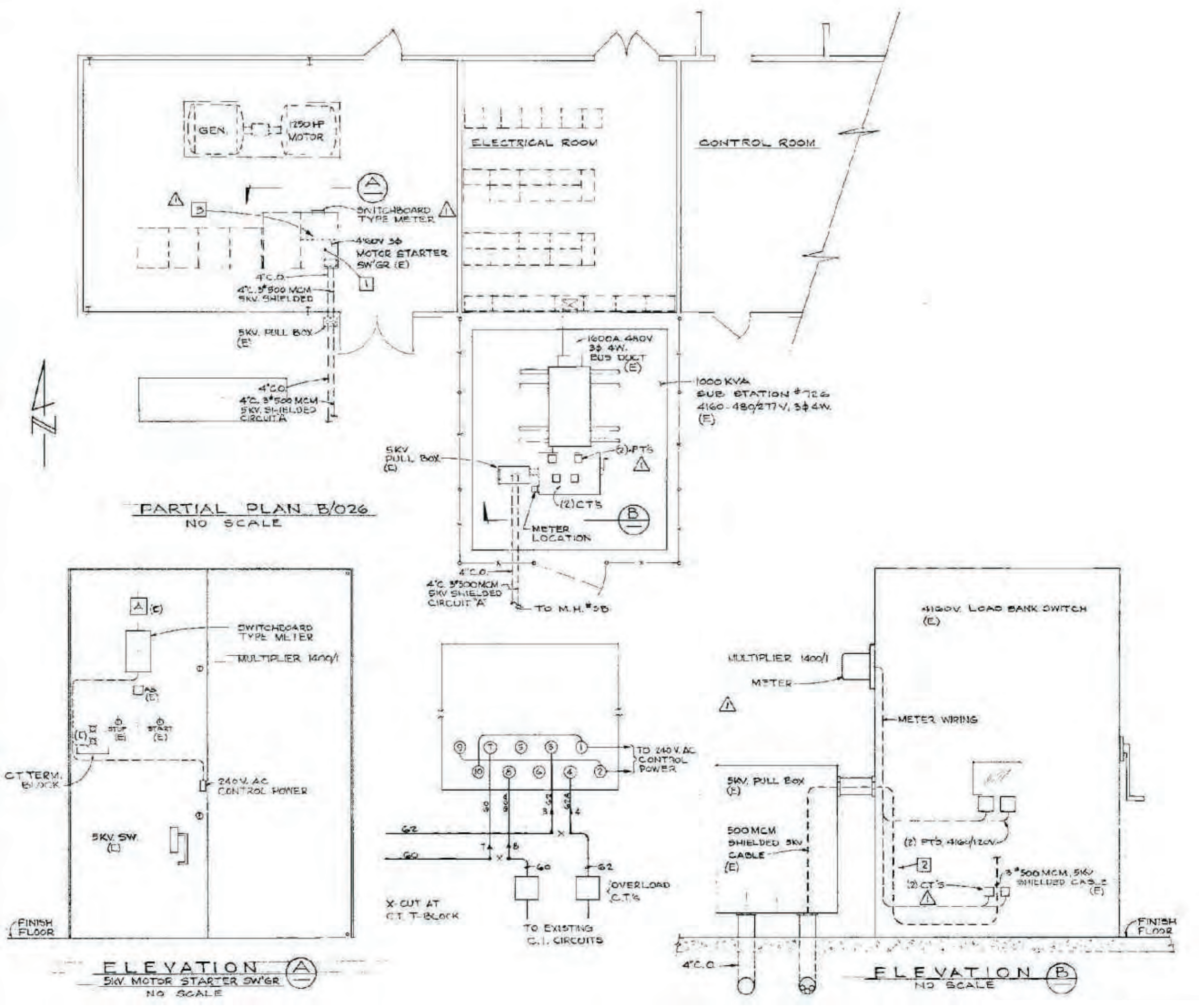

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Source: Boeing Company, 2008

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Figure 2.4.1c
Building 4026
Electrical Meter
Installation

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.4.1d
Building 4026
After Demolition
Photograph

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008*

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**Figure 2.4.2a
Building 4226
Site Photograph**

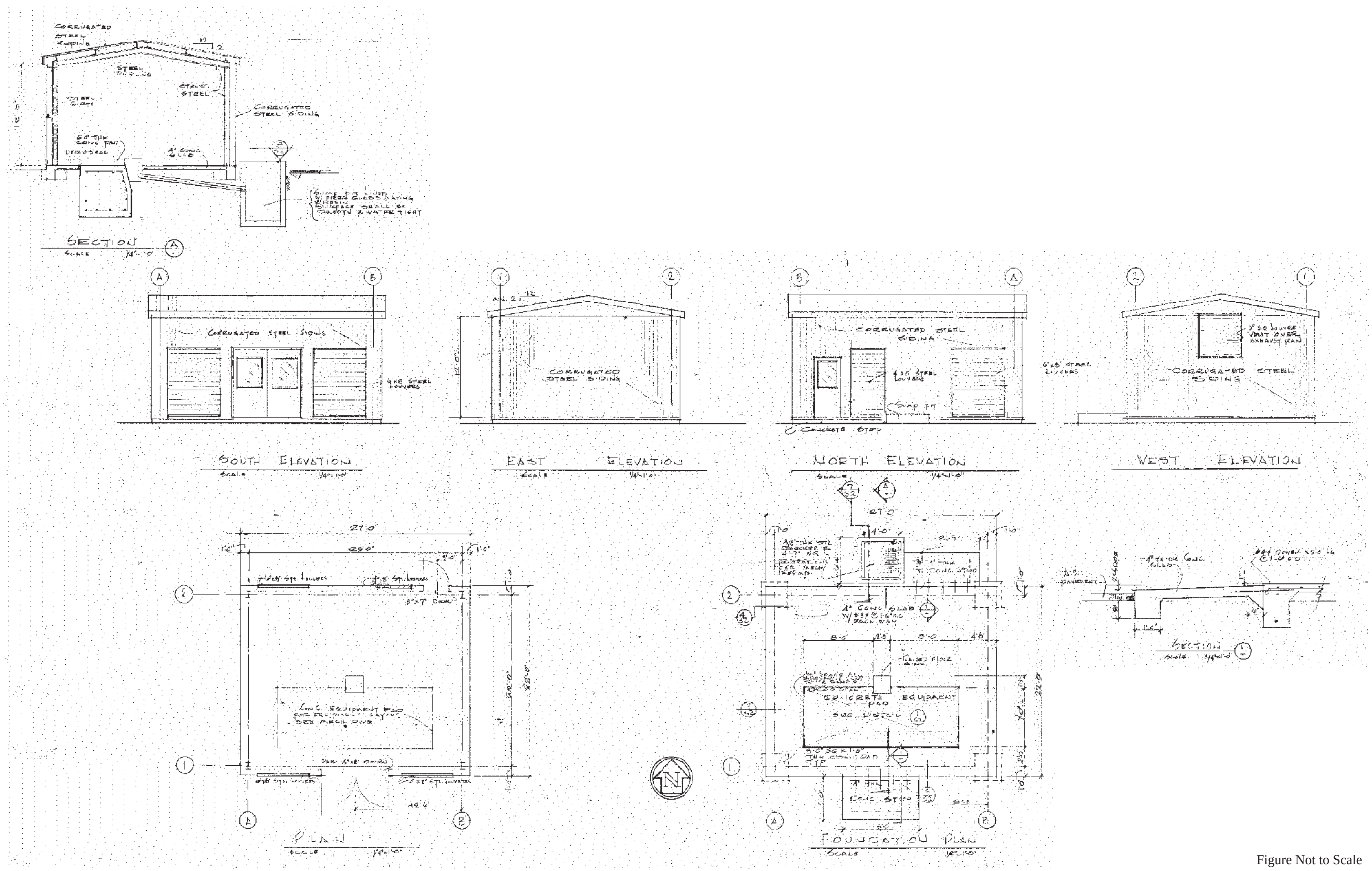

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Figure 2.4.2b
Building 4226
Foundation and
Elevations

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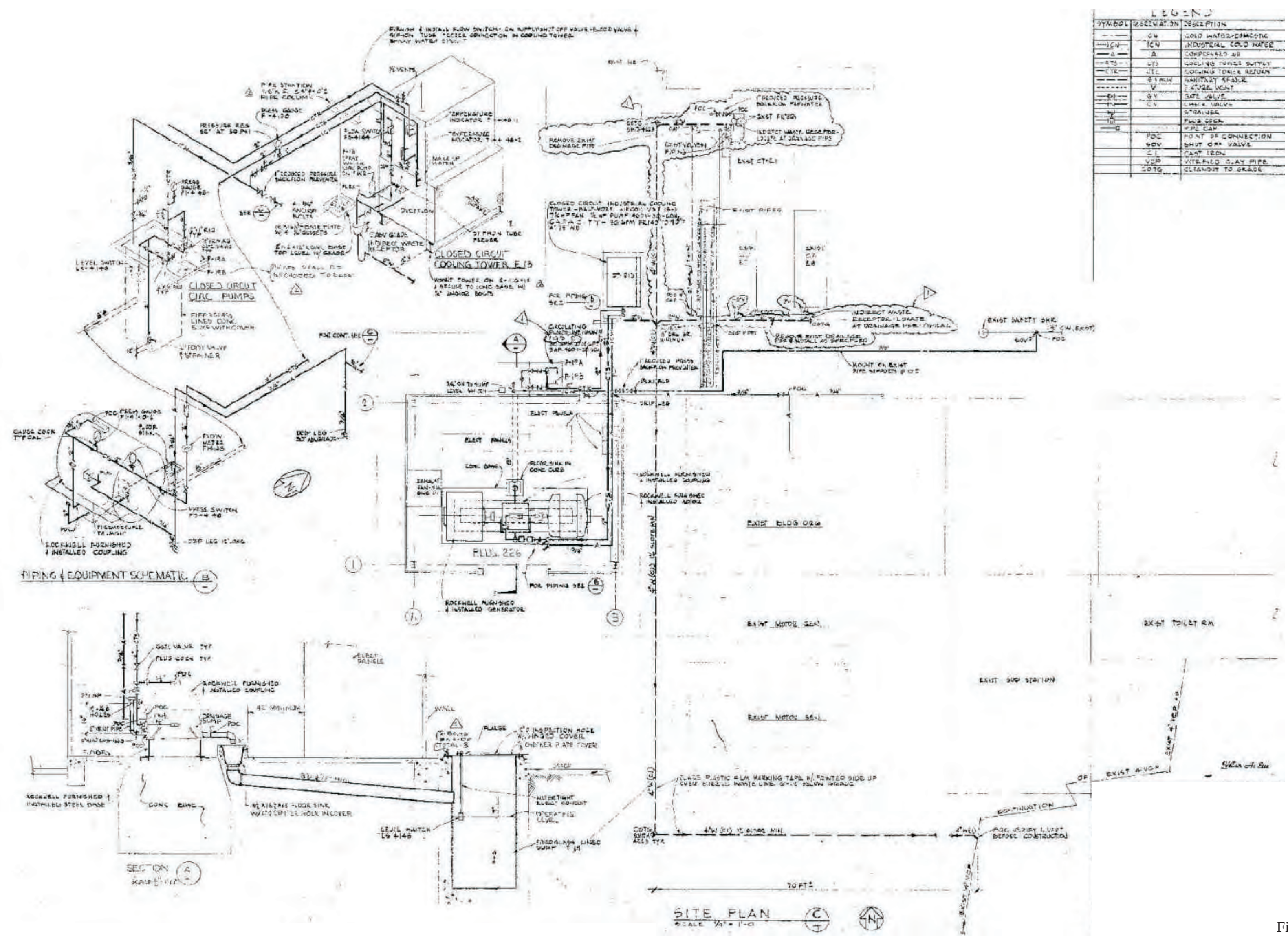

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Source: Boeing Company, 2008

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Figure 2.4.2c
Building 4226
Piping and Equipment

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.4.3a
Building 4358
Site Photograph

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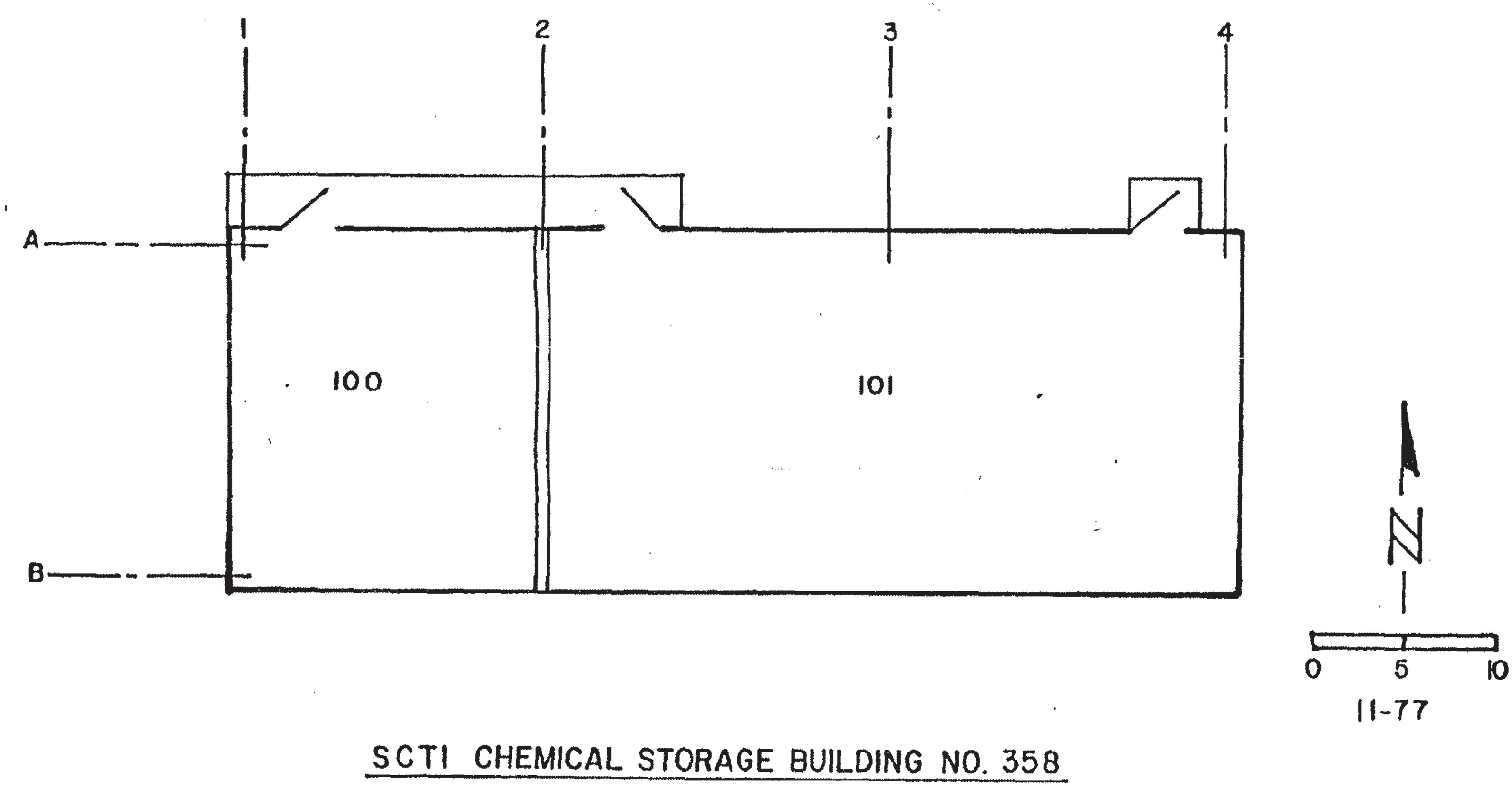

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.4.3b
Building 4358
Floor Plan

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

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Figure 2.4.4a
Building 4826
Site Photograph

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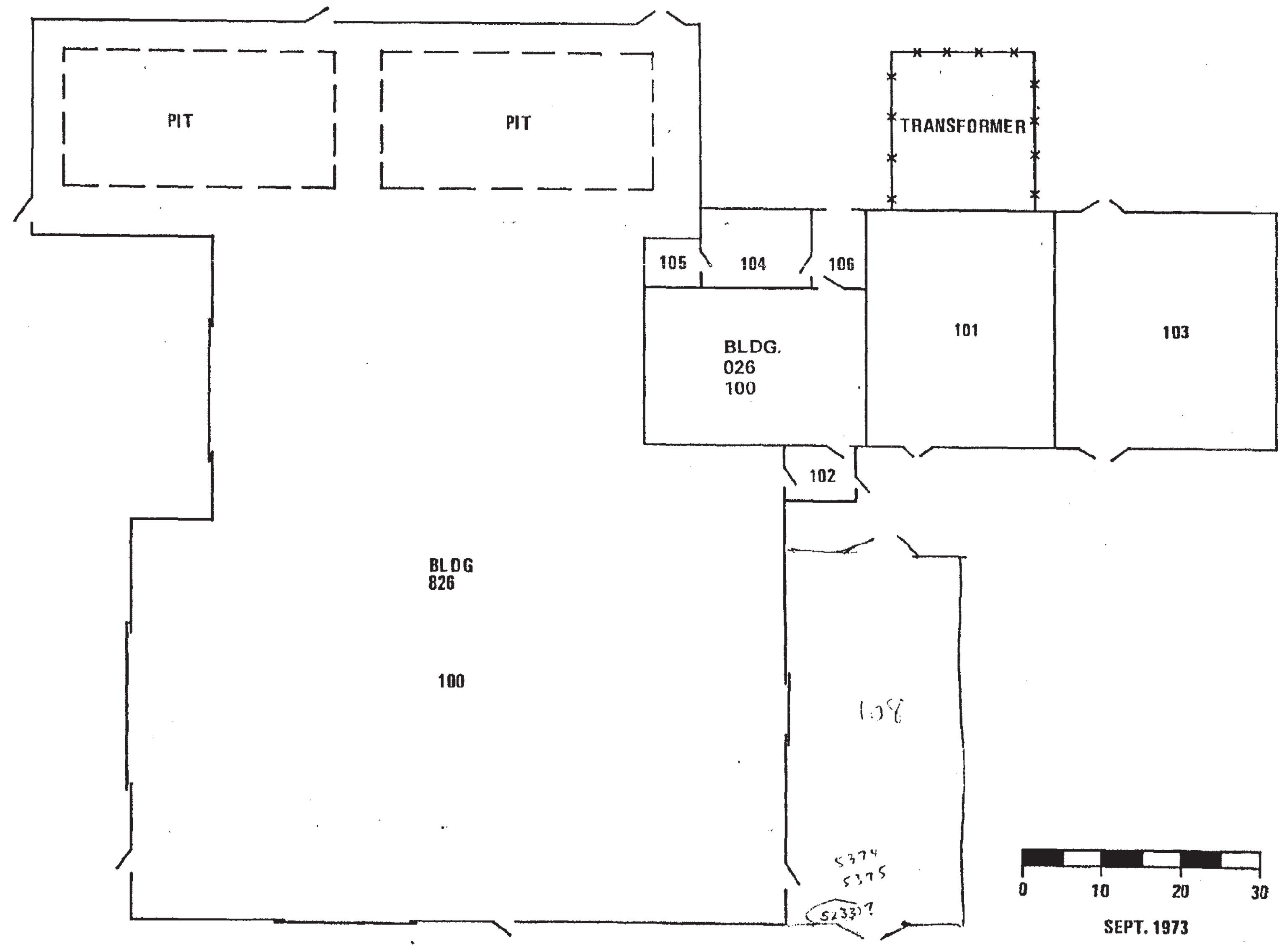

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.4.4b
SCTL
Floor Plan

Redacted

ETEC-12/16/96-394970

B/4826 SCTL T-2 & T-3 Sodium System Drain Tanks

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Revised: 06/24/2010 RB
Source: Boeing Company, 2008

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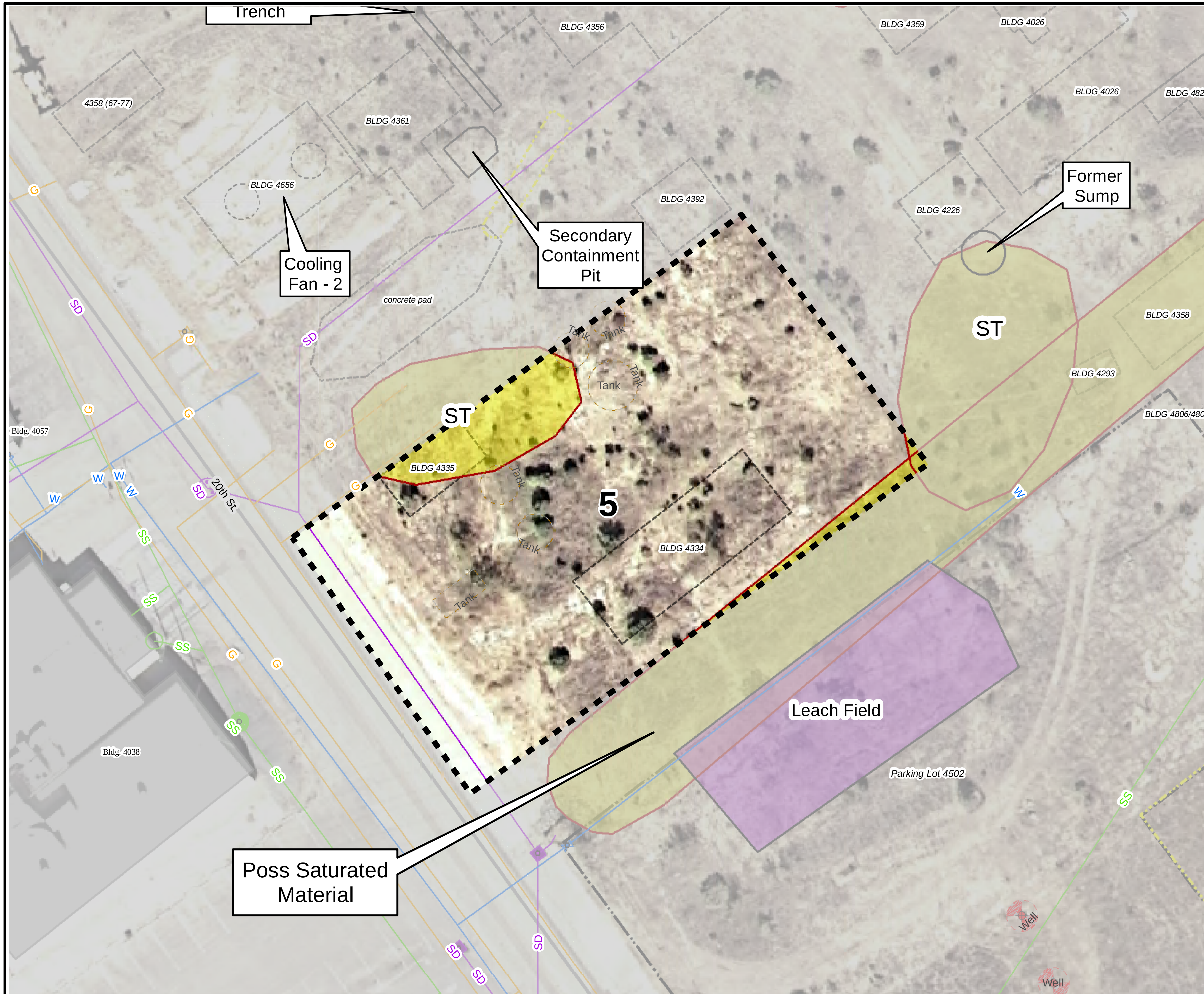
Figure 2.4.4c
Building 4826
Drain Tanks
Photograph

Figure 2.5
Area IV Subarea 5B-5
Santa Susana Field Laboratory

U.S. EPA Region 9



Legend

Subarea 5B-5 Boundary
Primary Roads
Secondary Roads
Underground Storage Tank
Unknown Tank Type
Sump
Dry Well
Tank Footprint
Above ground Storage Tank
Demolished Bldg.
Existing Bldg.
Parking Lots
Drainage
Drain
Well

Aerial Photo Features
Aerial Photography Features
Leach Field
Other

Surface Water
Intermittent Stream
Permanent Stream
Surface Water
Lined Channel
French Drain
Drainage
Leach Field
Septic System

Utilities
Channel
Drain
Drain
Drainage Divide
Gutter
Tank
Tank
Vault
Well
Gas
Storm Drain
Sanitary Sewer
Water

B	Building
CONT	Container
CR	Crates
DB	Debris
DG	Disturbed Ground
DTM	Dark Tone Material
EX	Excavation
FA	Fill Area
GS	Ground Scar
HT	Horizontal Tank
IM	Impoundment
MTMM	Medium Toned Mounded Material
OS	Open Storage
PA	Processing Area
PL	Parking Lot
POSS	Possible
PROB	Probable
S-T	Storage Tank
SS	Smoke Stack
ST	Storage
UO	Unidentified Object
VT	Vertical Tank
WDA	Waste Disposal Area

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

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Figure 2.5.1a
Building 4334
Site Photograph

Redacted

*Y:/Santa_Susana/EP9038/TM/HSA_5B
(2-5-2a)bldg4335.cdr
Project:EP9038
Revised: 09/08/2010 TJ
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**Figure 2.5.2a
Building 4335
Site Photograph**

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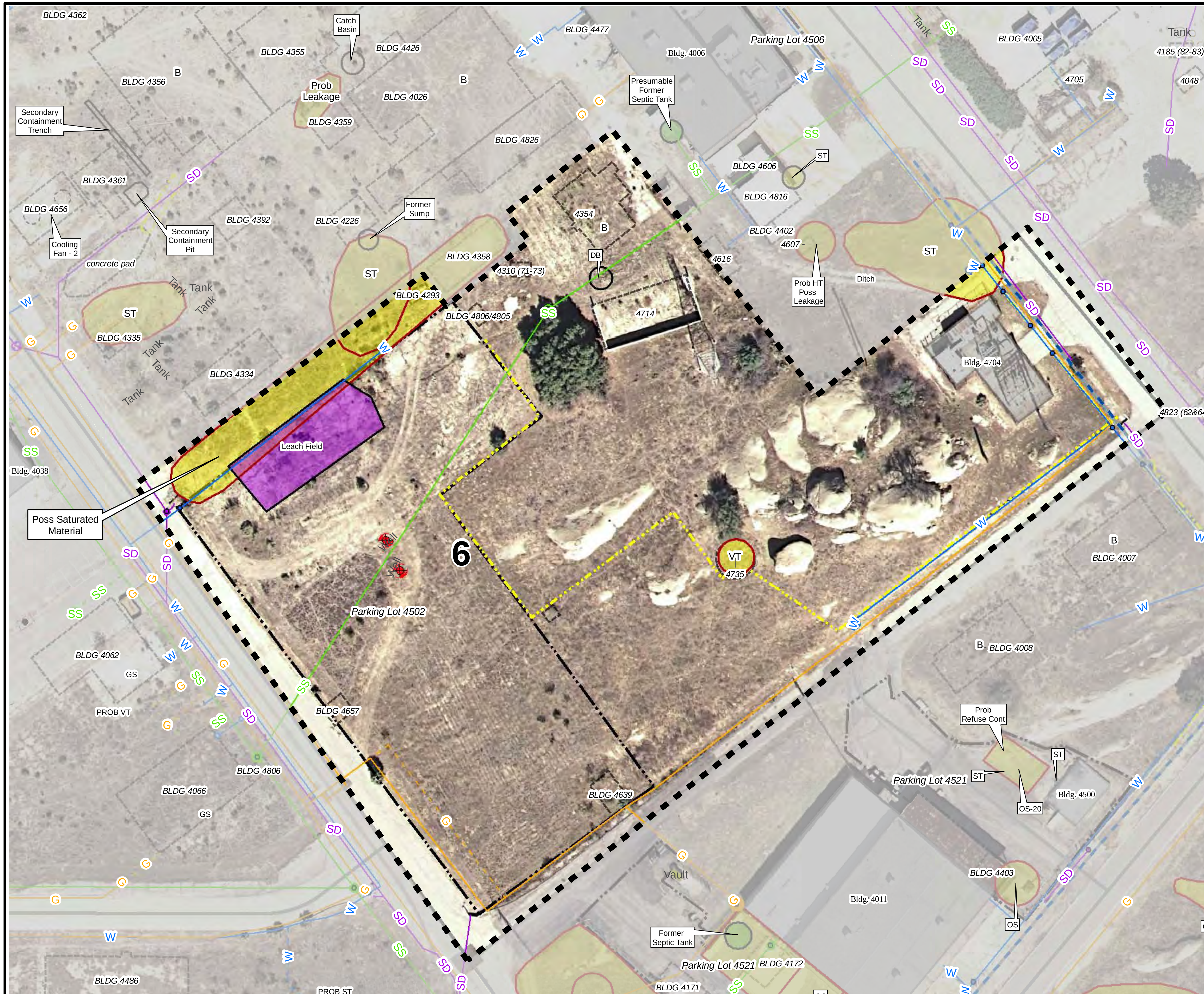

Historical Site Assessment
Final Technical Memorandum - HSA-5B

Figure 2.6
Area IV Subarea 5B-6
Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

- Subarea 5B-6 Boundary
- Primary Roads
- Secondary Roads
- Underground Storage Tank
- Unknown Tank Type
- Sump
- Dry Well
- Tank Footprint
- Above ground Storage Tank
- Demolished Bldg.
- Existing Bldg.
- Parking Lots
- Drainage
- Drain
- Well

Aerial Photo Features
- Aerial Photography Features
- Leach Field
- Other

Surface Water
- Intermittent Stream
- Permanent Stream
- Surface Water
- Lined Channel
- French Drain
- Drainage
- Leach Field
- Septic System

Utilities
- Channel
- Drain
- Drain
- Drainage Divide
- Gutter
- Tank
- Tank
- Vault
- Well
- Gas
- Storm Drain
- Sanitary Sewer
- Water

B	Building
CONT	Container
CR	Crates
DB	Debris
DG	Disturbed Ground
DTM	Dark Tone Material
EX	Excavation
FA	Fill Area
GS	Ground Scar
HT	Horizontal Tank
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MTMM	Medium Toned Mounded Material
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PA	Processing Area
PL	Parking Lot
POSS	Possible
PROB	Probable
S-T	Storage Tank
SS	Smoke Stack
ST	Storage
UO	Unidentified Object
VT	Vertical Tank
WDA	Waste Disposal Area

N

0 25 50 100
Scale In Feet

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HGL HydroGeoLogic, Inc

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Source: Boeing Company, 2008

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Figure 2.6.1a
Building 4293
Site Photograph

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Source: Boeing Company, 2008

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Figure 2.6.2a
Building 4310
Site Photograph

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008*

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**Figure 2.6.3a
Building 4354
Site Photograph**

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U.S. EPA Region 9

Figure 2.6.4a
Parking Lot 4502
Site Photograph

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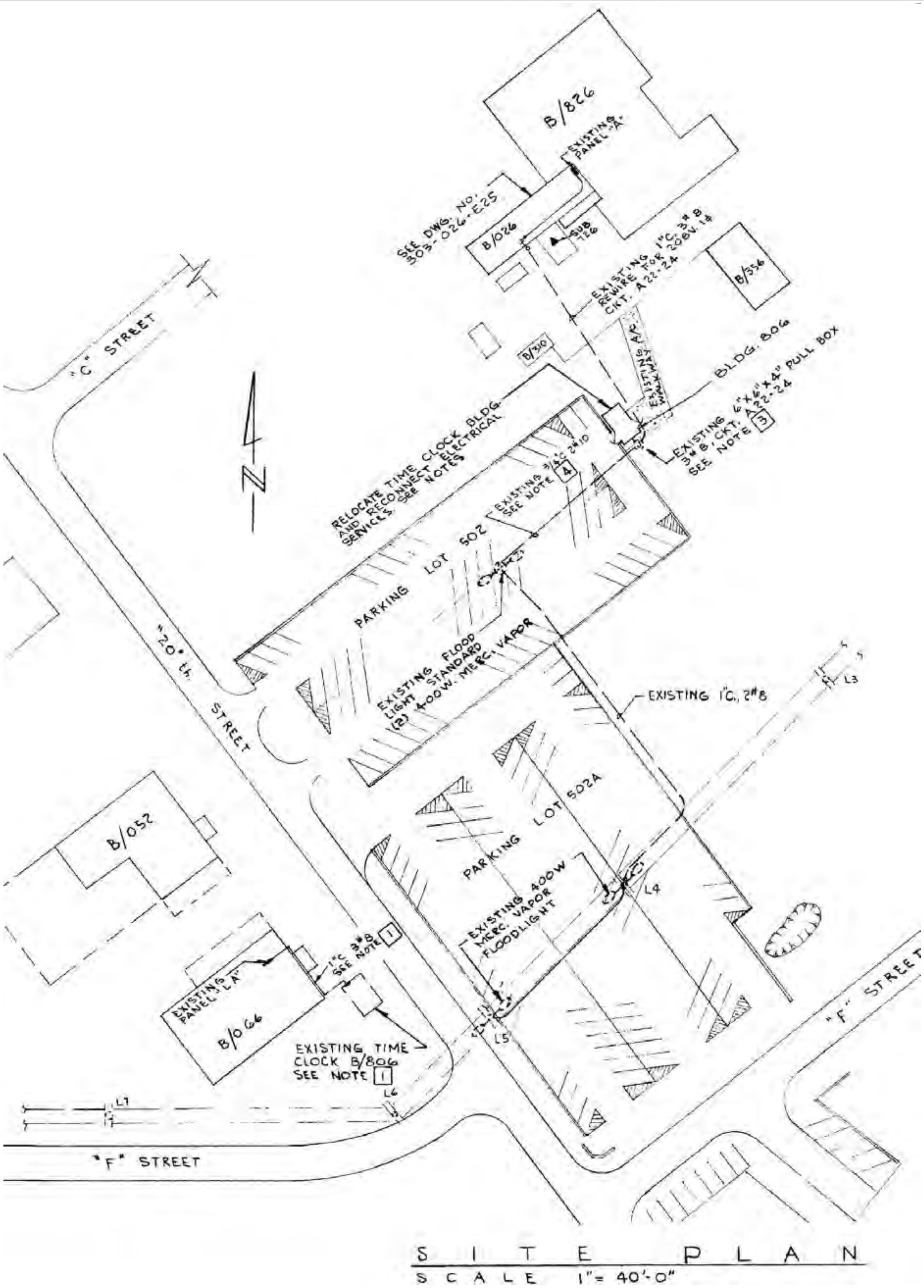

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.6.4b
Parking Lot 4502
Power and Lighting

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Revised: 09/08/2010 TJ
Source: Boeing Company, 2008

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Figure 2.6.5a
Building 4639
Site Photograph

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Figure 2.6.6a
Building 4704
Site Photograph

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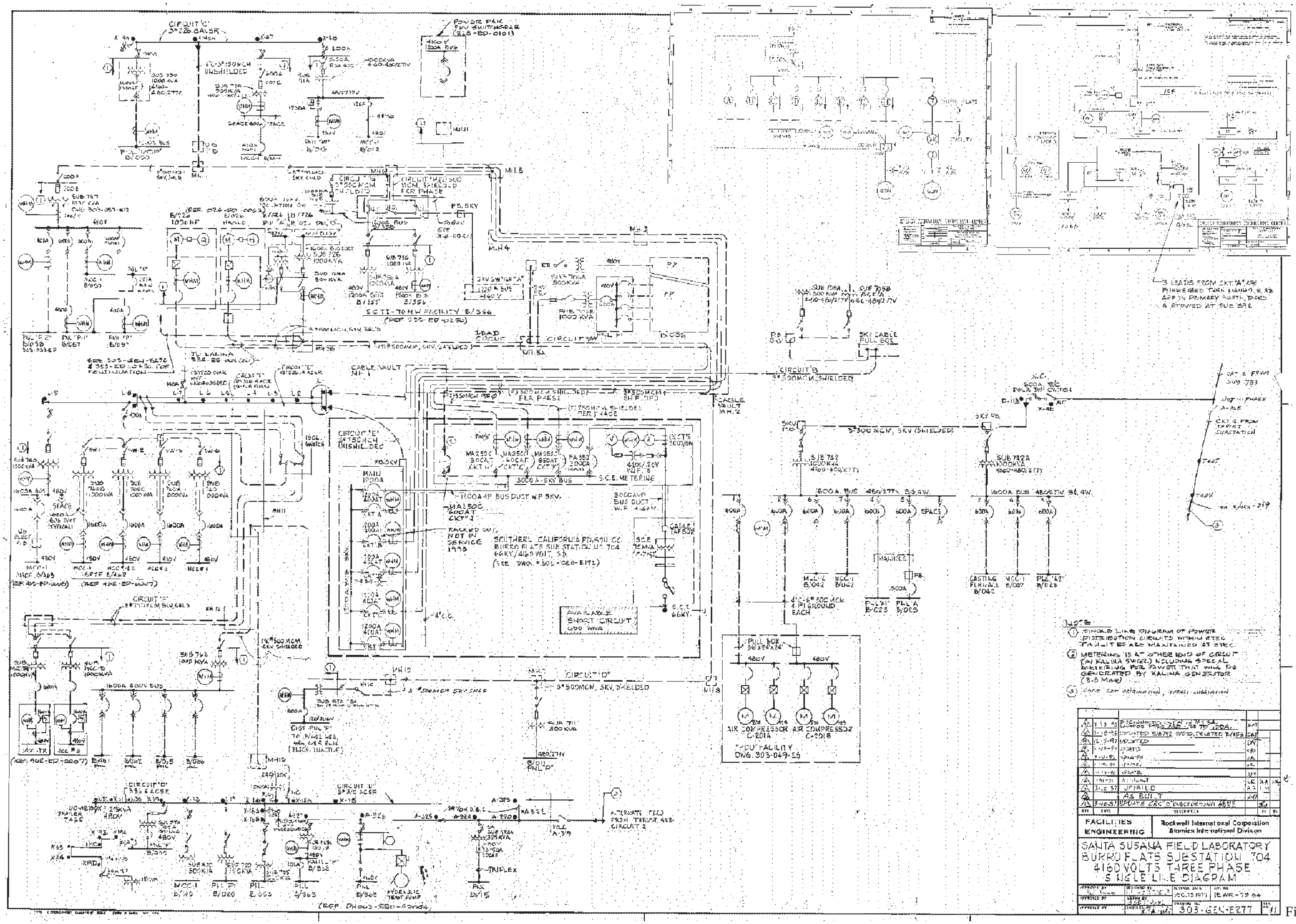

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Figure 2.6.6b
Building 4704
Substation Diagram

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Figure 2.6.7a
Building 4714
Site Photograph

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Source: Boeing Company, 2008

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Figure 2.6.8a
Fuel Tank 4735
Site Photograph

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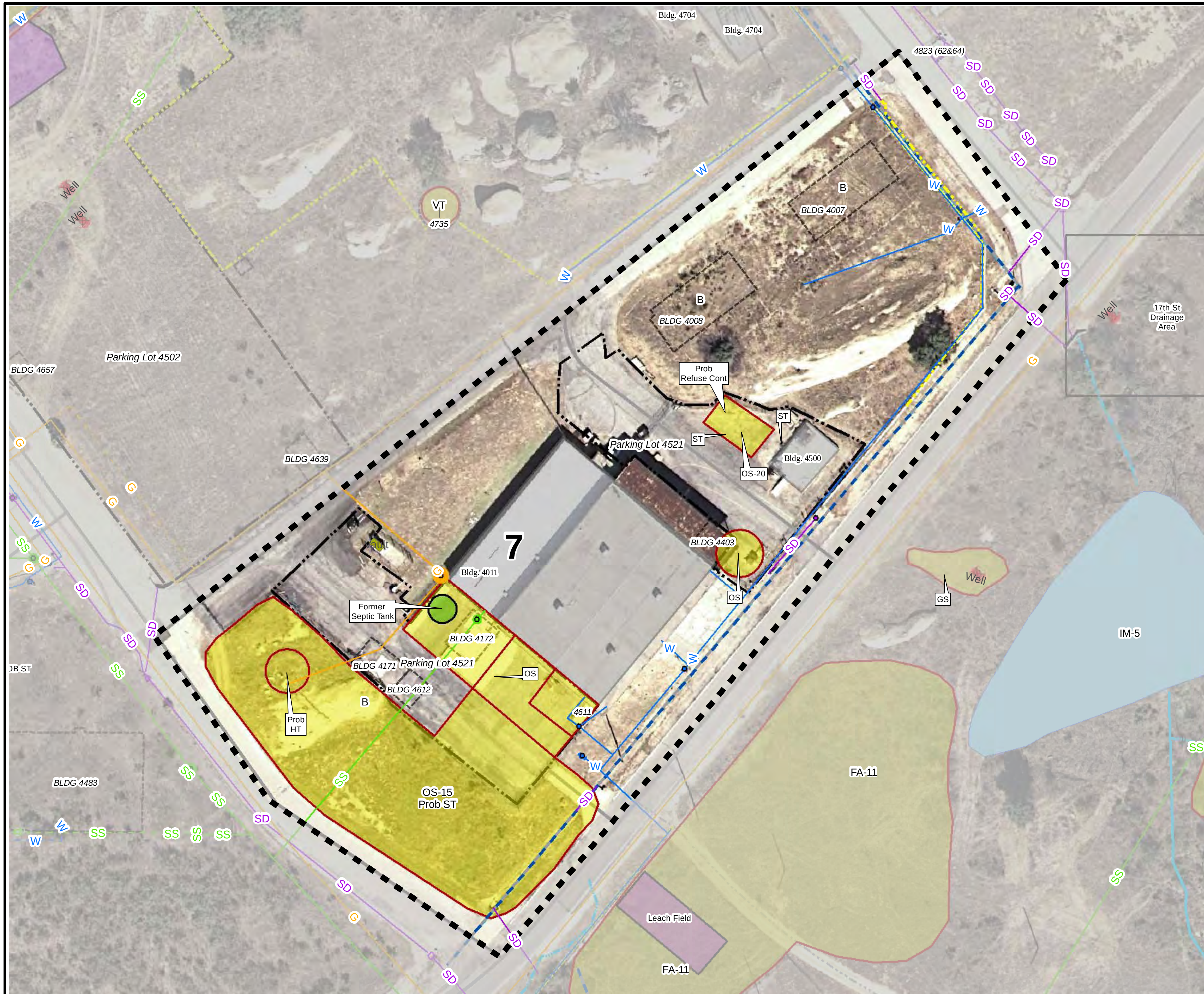
Historical Site Assessment
Final Technical Memorandum - HSA-5B

Figure 2.7
Area IV Subarea 5B-7
Santa Susana Field Laboratory

U.S. EPA Region 9



Legend

Subarea 5B-7 Boundary
Primary Roads
Secondary Roads
Underground Storage Tank
Unknown Tank Type
Sump
Dry Well
Tank Footprint
Above ground Storage Tank
Demolished Bldg.
Existing Bldg.
Parking Lots
Drainage
Drain
Well

Aerial Photo Features
Aerial Photography Features
Leach Field
Other

Surface Water
Intermittent Stream
Permanent Stream
Surface Water
Lined Channel
French Drain
Drainage
Leach Field
Septic System

Utilities
Channel
Drain
Drain
Drainage Divide
Gutter
Tank
Tank
Vault
Well
Gas
Storm Drain
Sanitary Sewer
Water

B	Building
CONT	Container
CR	Crates
DB	Debris
DG	Disturbed Ground
DTM	Dark Tone Material
EX	Excavation
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IM	Impoundment
MTMM	Medium Toned Mounded Material
OS	Open Storage
PA	Processing Area
PL	Parking Lot
POSS	Possible
PROB	Probable
S-T	Storage Tank
SS	Smoke Stack
ST	Storage
UO	Unidentified Object
VT	Vertical Tank
WDA	Waste Disposal Area

N

0 25 50 100
Scale In Feet

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**Figure 2.7.1a
Building 4007
Site Photograph**

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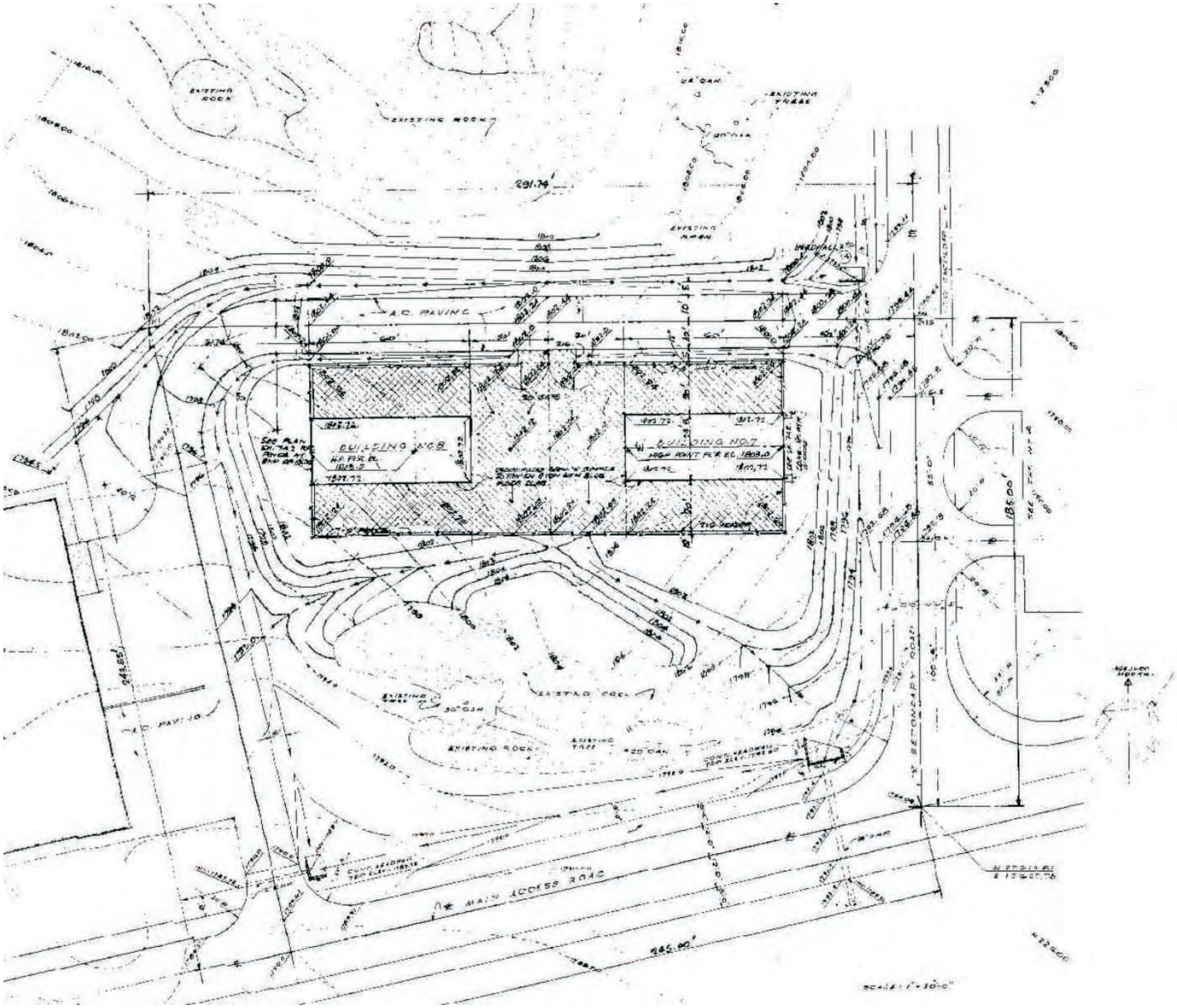

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Source: Boeing Company, 2008

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Figure 2.7.1b
Building 4007
Paving and Grading

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Figure 2.7.2a
Building 4008
Site Photograph

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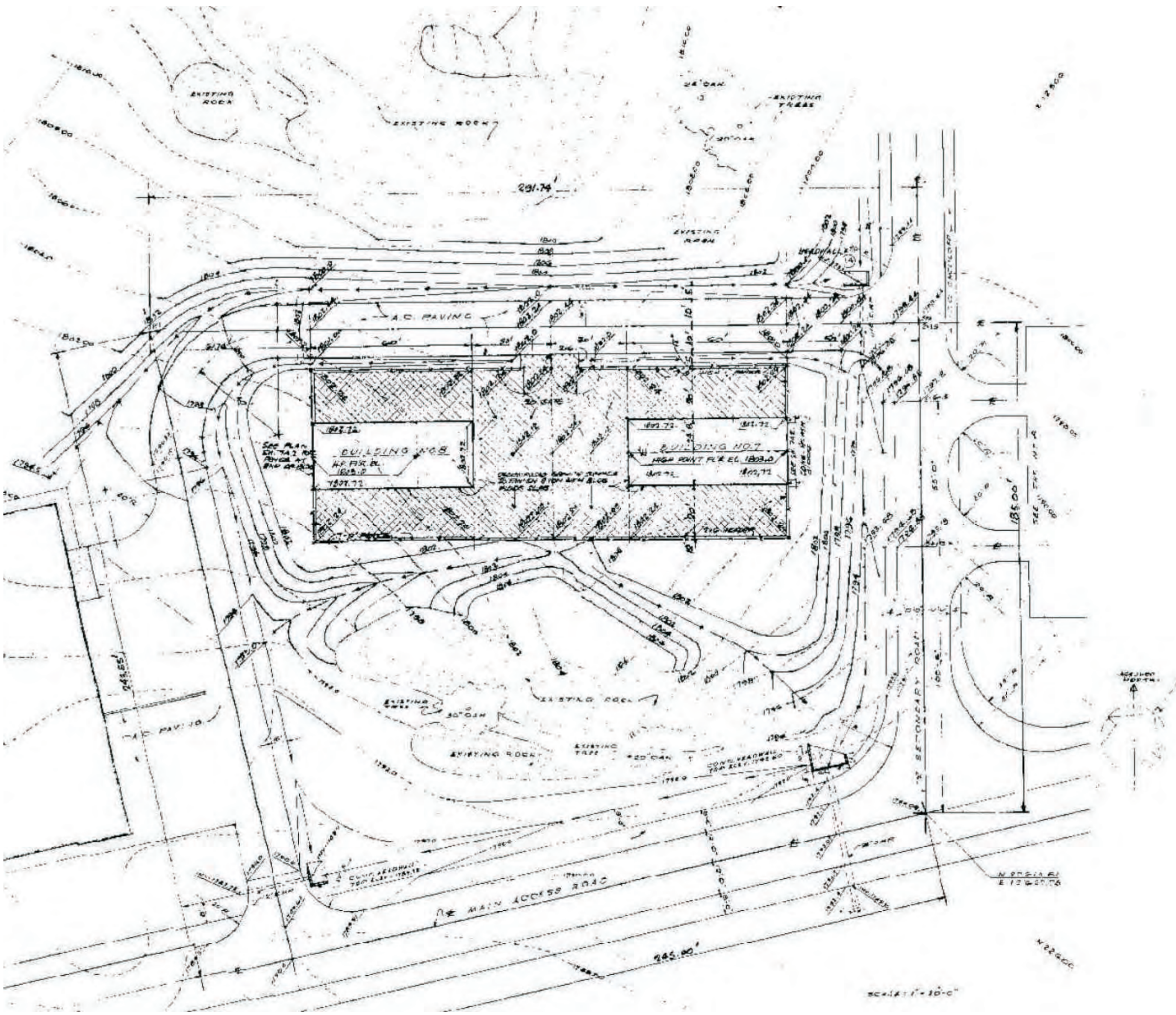

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Figure 2.7.2b
Building 4008
Paving and Grading

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.7.3a
Building 4011
Site Photograph

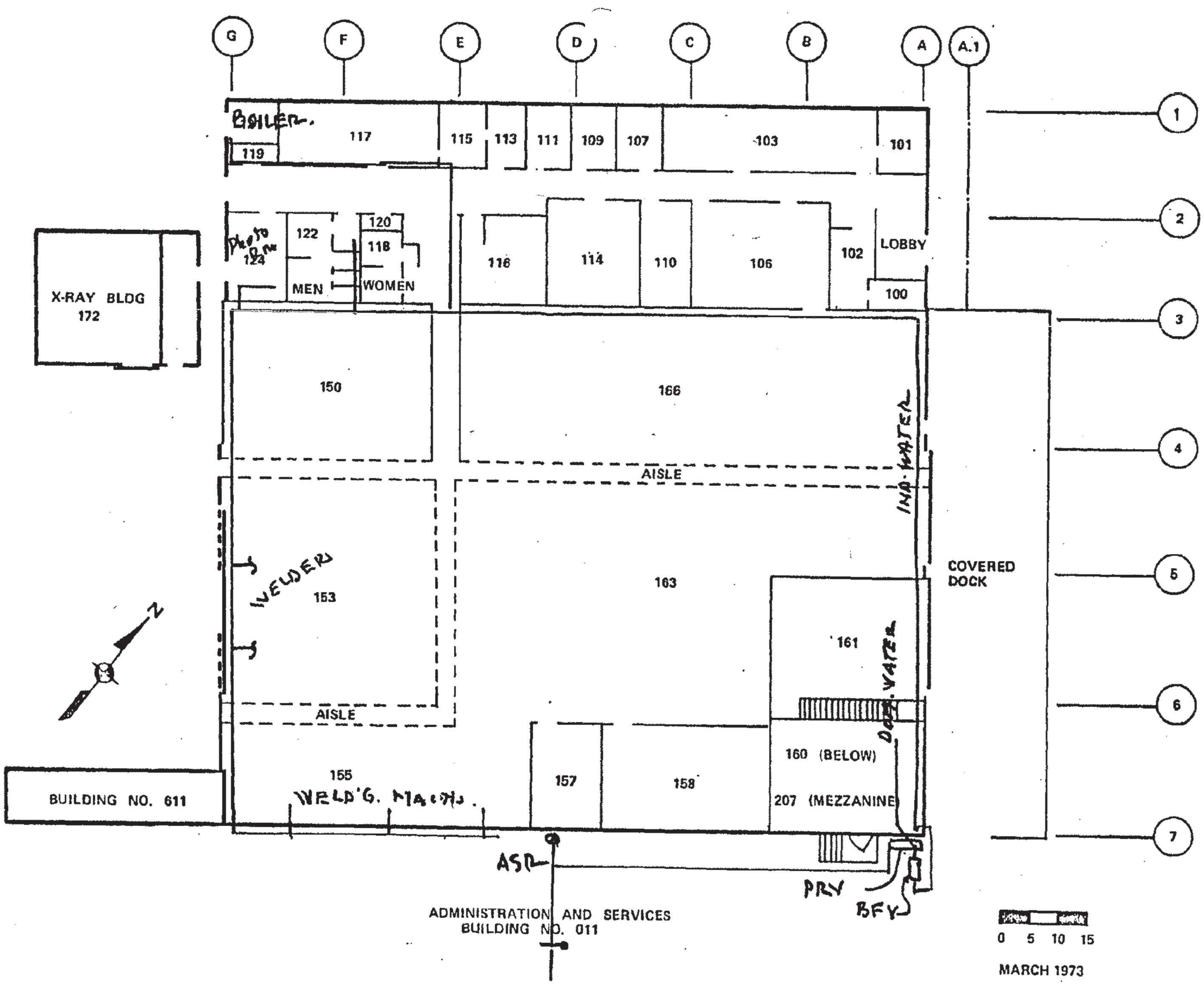

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Figure 2.7.3b
Building 4011
Floor Plan

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Source: Boeing Company, 2008

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Figure 2.7.3c
Building 4011
Septic Area
Photographs

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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.7.3d
Building 4011
Leach Field
Photograph

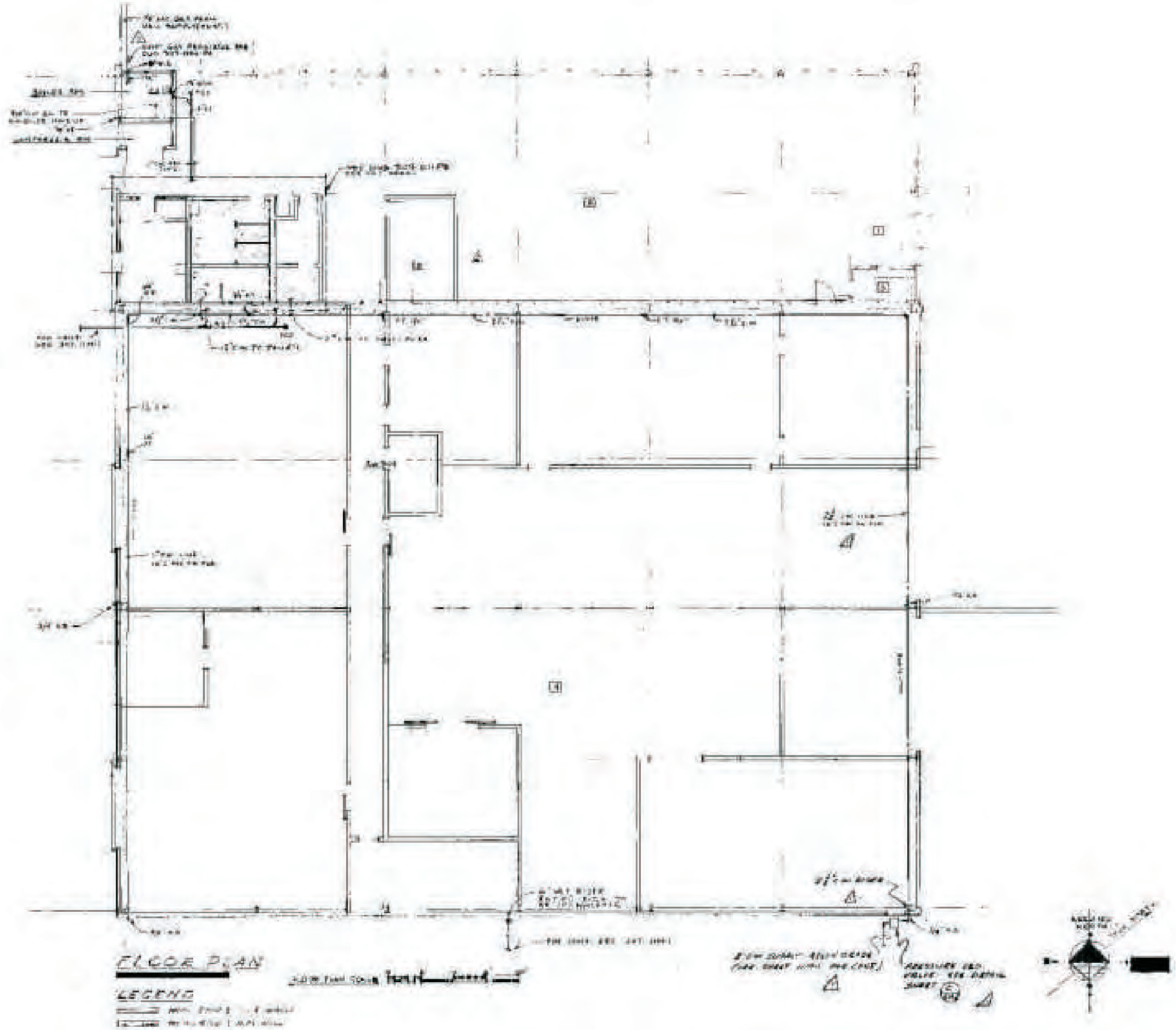

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Figure 2.7.3e
Building 4011
Plumbing Plan

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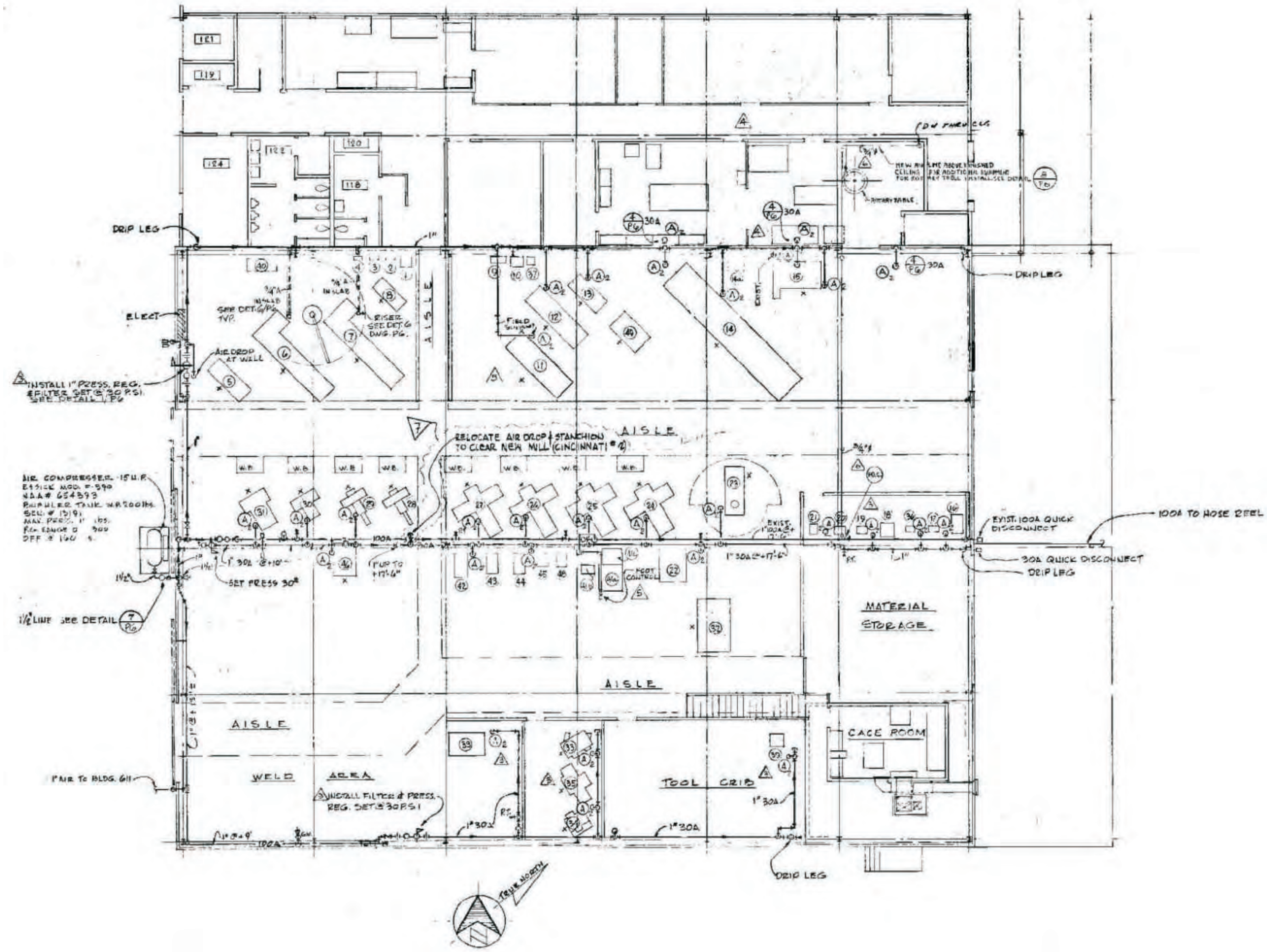

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U.S. EPA Region 9

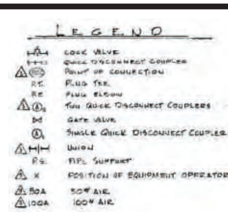

Figure 2.7.3f
Building 4011
Air Piping Plan

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Figure 2.7.4a
Building 4171
Site Photograph

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Figure 2.7.5a
Building 4172
Site Photograph

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Figure 2.7.6a
Building 4500
Site Photograph

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U.S. EPA Region 9

Figure 2.7.7a
Parking Lot 4521
Site Photograph

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Source: Boeing Company, 2008

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Figure 2.7.8a
Building 4611
Site Photograph

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Figure 2.7.9a
Building 4612
Site Photograph

Redacted

Historical Site Assessment
Final Technical Memorandum - HSA-5B

Figure 2.8
Area IV Subarea 5B-8
Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

- Subarea 5B-8 Boundary
- Primary Roads
- Secondary Roads
- Underground Storage Tank
- Unknown Tank Type
- Sump
- Dry Well
- Tank Footprint
- Above ground Storage Tank
- Demolished Bldg.
- Existing Bldg.
- Parking Lots
- Drainage
- Drain
- Well

Aerial Photo Features

- Aerial Photography Features
- Leach Field
- Other

Surface Water

- Intermittent Stream
- Permanent Stream
- Surface Water
- Lined Channel
- French Drain
- Drainage
- Leach Field
- Septic System

Utilities

- Channel
- Drain
- Drain
- Drainage Divide
- Gutter
- Tank
- Tank
- Vault
- Well
- Gas
- Storm Drain
- Sanitary Sewer
- Water

B	Building
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CR	Crates
DB	Debris
DG	Disturbed Ground
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PL	Parking Lot
POSS	Possible
PROB	Probable
S-T	Storage Tank
SS	Smoke Stack
ST	Storage
UO	Unidentified Object
VT	Vertical Tank
WDA	Waste Disposal Area

N

0 25 50 100
Scale In Feet

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(2-8-1a)17thDrainage.cdr
Project:EP9038
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U.S. EPA Region 9

Figure 2.8.1a
17th Street
Drainage Area
Site Photograph

Redacted

REPORTED INCIDENTS
NOT RESULTING IN ENVIRONMENTAL RELEASE

Building 4010

- On October 19, 1965, a high level of contamination (2 x 10^4 disintegrations per minute) was released into the high bay of Building 4010 during one of two operations. Cutting of the control drum drive rods to remove the beryllium control drums and reflectors or possibly changing of the saw blade resulted in cobalt-60 (Co-60), manganese-54 (Mn-54), and iron-59 (Fe-59) contamination in the high bay area. The level of contamination was found to be 200 millirads per hour (mrad/hr), including 100 milliroentgens per hour (mR/hr) due to gamma (Incident Report A0349).[1]

Building 4013

- On April 9, 1963, it was reported to the health and safety department that a personal film badge showed an exposure of 7.67 rem, which had occurred in the month of March. The film badge indicated exposure was due to low energy x-rays. The film badge was issued to an employee whose normal work assignment was in Building 4013, which contained a materials inspection x-ray booth with a 140 peak kilovoltage (kvp) x-ray machine. However, the employee also had a dermal condition on his right hand that was treated with high doses of low energy x-rays. Investigation found that it was possible the medical condition treatments could have affected the film badge and the health and safety department thought this was the most likely source of exposure and not the x-ray at Building 4013. The employee was issued two other film badges to take with him to the doctor's office to see if any exposure resulted (A0369).[2]

Building 4013

- On April 10, 1976, a 45 Curie iridium-192 (Ir-192) gamma source was being used to gammagraph welds on a large tank in Building 4019. The operator had run the source out for the first exposure and upon completion of the exposure time, he returned the source to the safe. As was standard practice, the operator took the survey instrument, a 5R Tech Associates Juno, with him to make sure the source was returned to the safe. The Juno indicated high level radiation and the operator left the area immediately and notified Industrial Security. At the time the operator and his helper were not wearing film badges, although one of the men had a dosimeter that indicated whole body dose of 12 millirems was received. All personnel were issued film badges and dosimeters before any attempt to return the gamma source to the safe was made. It was determined that the Ir-192 source was detached from the travel cable. A lead weight was positioned over the 7-foot cable containing the source to reduce the radiation levels to 150 milliroentgens (mR). This allowed the end of the 7-foot cable to be cut so the 21-foot travel cable could be

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[1] Owen, R.K., *Incident Report, Building 010, Santa Susana*, October 21, 1965, HDMSP00050442.
[2] Internal Correspondence from Owen, R.K. to Busick, D.D., Atomics International, *Re: Investigation of Possible Overexposure of Personal Film Badge Issued to Redacted D/722-261*, April 11, 1963.

inserted to push the source out until the connector ball was exposed and the source could be fastened to the travel cable and returned to the safe. Radiation intensities at the connection point ranged from 3.5 roentgens per hour (R/hr) to greater than 5 R/hr. The source was reconnected and returned to the storage safe, which was verified by instrument survey. It was not known what caused the source to become disconnected from the cable (A0304).[1]

Building 4025

- On November 16, 1979, a radiograph operator reported that his dosimeter was off scale after conducting a routine radiograph of a check valve in Building 4025 using a columnated source of approximately 72 Curies of Co-60. A fellow employee working in the same area at the same time only reported 2-3 millirems (mr) on his dosimeter. The area both men were working in was roped off and monitored during the radiography operations with no signs of problems. The employee's film badge was sent for processing and he was not allowed to perform any other radiographic operations until the results were received. The film badge results showed an exposure of 150 mr from October 1, 1979 to November 16, 1979, indicating that the dosimeter reading had been incorrect. It was not known what caused the dosimeter to go off scale, but the employee was released to perform radiographic work (A0306).[2]

Building 4355

- On April 15, 1988, a truck driver from Sparkletts Water Company was observed passing through the radiation barrier ropes at the northwest corner of Building 4355 while making a water delivery to a construction trailer. The radiographer directed the truck driver to immediately leave the radiation area and report to the facility shift leader. The Ir-192 source used in radiography was found to be locked in its safe during the time frame the truck driver was inside the barrier rope so there was no chance of exposure. The truck driver was instructed on the hazards of radiation and the importance of observing all posted areas (A0184).[3]

Building 4356

- On October 7, 1974, during a semi-annual sealed source inspection and leak test, a 186 millicurie (mCi) Cs-137 liquid sodium level source mounted on expansion tank number 5 was found to be missing. The source was subsequently found at an interior storage area

[1] Internal Correspondence from Owen, R.K to Tuttle, R.J., Rockwell International, *Re: Gammagraphing Incident T-019*, April 20, 1976.
[2] Internal Correspondence from Vandervort, P.S. to Tuttle, R.J., Rockwell International, *Re: Dosimeter Reading Off Scale*, November 28, 1979.
[3] Internal Correspondence from Hunnicutt, T.D. to Tuttle, R.J., Rockwell International, *Re: Breach of Safety Barrier*, April 18, 1988.

where the source was leak tested. The source was confirmed to be intact and was then stored properly (A0639).[1]

- On February 20, 1986, two radiographers were working on the west end of the H2 heater at SCTI Building 4356. They were using a 23 Ci Ir-192 source with a 60 degree tungsten collimator aimed in the southeast direction. Barricades were set up and left in place during different radiography exposures. During one set up, the source was cranked out and one of the radiographers surveying the area found two employees working on the northeast corner of the nearby H1 heater. The employees were standing inside the barricade area and the barricade had been taken down. They were about 60 feet north of the Ir-192 source and in the opposite direction of the beam. The two employees were directed to leave. With the exposure still in progress, a survey was done in the area the employees were working in and indicated that the dose rate was less than 0.5 mR/hr. The incident appeared to be a result of a misunderstanding and stricter compliance with existing policies and procedures was called for to prevent removal of barriers or signs by non-authorized personnel (A0153).[2]

Building 4006

- On August 11, 1960, six zirconium samples from sodium reactor experiment moderator cans were prepared for examination in the metallurgical laboratory of Building 4006. The samples were ground and electrically polished for microscopic examination of grain size and hydride content. During the operation a clean area became contaminated with activation products as well as an employee's clothes and neck. The employee's neck became contaminated when he rubbed a contaminated sleeve against his neck. He washed his neck until no significant contamination was detected. An air sample taken during the polishing operation revealed 5×10^{-10} microcuries per cubic centimeter. The metallurgical laboratory was temporarily made a blue tag area during the operation. The Work was allowed to continue only after surveying revealed no further contamination (A0484).[3]

Building 4026

- On September 10, 1969, an employee disregarded a rope barrier signifying a radiation area where a 13 Curie (Ci) iridium-192 (Ir-192) gamma radiography source was exposed during inspection of electrical equipment. The dose rate from the source was about 75 rems per hour (rem/hr) at one foot away and the employee was reportedly 12 feet from the source where the radiation field would have been about 520 millrems per hour (mrem/hr) without shielding. The measured dose rate at the employee's location taken

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[1] Internal Correspondence from Moore, J.D. to Tuttle, R.J., Rockwell International, *Re: Cesium-137 Source Removal, Bldg. 356, SCTI*, October 9, 1974.
[2] Internal Correspondence from Badger, F.H. to Radiation & Nuclear Safety Group, Rockwell International, *Re: Radiological Safety Incident Report, SCTI, T356, H2 Heater, 2/20/86*, March 18, 1986.
[3] Internal Correspondence from Warren, J.W. to Fisher, W.L., Atomics International, *Re: Radiological Safety Incident Report, Metallurgical Lab. Bldg. #006, 8/11/60*, September 30, 1960.

during a later exposure was found to be 120 mrem/hr, which would have given the employee a radiation dose of 2 mrem because the source was exposed for 1 minute. The radiation dose would have been delivered to the employee's head and torso. This was noted as a rule violation, although the employee stated he was not aware of the rope barrier. Recommendations included better training for personnel on the hazards of radiography and better radiation warning devices that use flashing lights or audible sounds (A0465).[1]

- On October 3, 1979, an iridium-192 source used in a routine pipe-weld radiographic exposure could not be retracted into the storage shield of the test instrument. The exposure was made in the eastern part of Building 4026. The maximum exposure rate found was 300 milliroentgens per hour (mR/hr) at 15 feet from the equipment setup. The exterior of Building 4026 was surveyed with the source in the collimator and no areas with exposure rates in excess of 0.5 mR/hr were found. The iridium source was eventually retracted on October 4, 1979 (A0238).[2]

Building 4011

- On July 14, 1964, a security patrol observed empty radioactive shipping containers in a private car near the intersection of F and 19th Street. A survey indicated no detectable radiation or contamination present in the area or on the vehicle. The health physics department recommended the cans be picked up and transported to the "ETB annex" and the employee be reminded of the standard operating procedures regarding movement of items in a private vehicle (A0519).[3]

- On July 2, 1980, a welder's visitor film badge showed an exposure of 1,490 millrems (mrem). A subsequent film badge checked out to the employee showed 20 mrem for a total of 1,510 mrem. This exposure exceeded the 1,250 mrem limit for a quarter. If the employee had regularly worked in radiation areas, the allowable limits would have been 3,000 mrem. The film badge showing the large exposure was investigated by reviewing working conditions, interviewing personnel involved, and reviewing dosimetry results. No likely cause for the exposure was identified. During the time of the large exposure, the employee welded 15 Rad-Pac sources containing 65 millicuries of tantalum-182 (Ta-182) each. It was noted that exposures of the magnitude identified in the film badge were not normally associated with this job and that the mechanic who had difficulty unloading and sorting the sources prior to welding only received 210 mrem. A number of hypotheses were reviewed as to how the film badge received such a high exposure, including error in processing or exposure from field radiography near the employee's toolbox where he sometimes stored his badge. Ultimately, the exposure was recorded in

[1] Internal Correspondence from Bresson, J.F. to Heine, W.F., Atomics International, *Re: Violation of Radiation Barrier and Signs at SS026*, September 18, 1969.
[2] Tuttle, R.J., *Unretractable Iridium-192 Source, SCTL, October 3, 1979*, Rockwell International, October 8, 1979, pgs. 1-2.
[3] Internal Correspondence from Clow, H.E. to Hill, R.M., Atomics International, *Re: Incident Report, B/11, Corner of 19th and F Street, 7-14-64*, July 15, 1964.

the employee's history with a note that the exposure did not appear to be a real, personal exposure (A0083).[1]

- On April 13, 1985, a high level gamma instrument calibrator source became disconnected from the source control rod. Two days later a member of the radiation and nuclear safety group was called to Building 4011 to examine the "problem." A radiation survey of the calibrator was conducted with no exposure hazard observed. The high level calibrator source capsule, containing approximately 40 Curies of cesium-137 (Cs-137), was no longer connected to the source handling rod. There were no signs of contamination on any part of the rod, which would have indicated the rupture of the sealed source capsule. It was thought that the source itself was still in the source shield at or near the normal storage position. The principal user of the calibrator looked through available drawings and contacted the calibrator supplier, Technical Associates, for assistance. The problem appeared to be the result of loose screws and the shearing of a screw. Plans were made to remove the broken screw and any other loose pieces and reattach the source to the source rod. The source was to remain fully shielded throughout the repair operation and thus no measureable radiation exposure above background was expected. The incident report notes that better observation of the operating conditions of the equipment and periodic preventative maintenance could prevent future incidents (A0318).[2]

- On January 6, 1994, the instrument calibration shop in Building 4011 reported the discovery of two regulated air supply sampling pumps with detectable radioactive contamination on the internal surfaces of the air mover chamber and impellers. These pumps were used for air sampling. The external surfaces of the pumps were surveyed for release prior to transferring them to the instrument shop in Building 4011. The internal surfaces of the pumps were not accessible for survey, but despite this the pumps were declared uncontaminated and released. The pumps were placed in storage in Building 4011 in an unlocked room. This failure to label and control the contaminated pumps constituted a loss of control of radioactive materials (A0651).[3]

- On December 6, 1994, a Cs-137 calibration source dislocated from the release pull rod. The source was left in a safe position with no release of activity. The Building 4011 calibration lab was immediately secured and the radiation protection department was notified. A radiation/contamination survey of the source containment box and release pull rod indicated normal background levels. The source containment box was red tagged. According to the incident report, the release pull rod probably broke due to wear and age (A0658).[4]

[1] Internal Correspondence from Tuttle, R.J. to Remley, M.E., Rockwell International, *Re: Investigation of Film Badge Exposure*, November 7, 1980.
[2] Internal Correspondence from Speed, D.L. to Tuttle, R.J., Rockwell International, *Re: Cesium Calibrator Source Control Rod Disconnect and Reconnection Plans*, April 16, 1985.
[3] Internal Correspondence from Barnes, J. to Incident File, Rockwell International, *Re: Loss of Control of Radioactive Materials Inadequate Release Surveys*, January 6, 1994.
[4] Internal Correspondence from Wallace, J.H. to Rutherford, P.D., Rockwell International, *Re: Radiological Incident Report, T011 Calibration Lab*, December 6, 1994.

Building 4172

- On April 13, 1977, during an x-ray tube warm up period, the x-ray tube beam was directed at the x-ray control room approximately 7.5 feet from the wall. The machine was operated for 15 minutes. Three sheets of 70 millimeter film were developed against the darkroom wall closet to Building 4172. A manager in radiation and nuclear safety department was in the control room of Building 4172 during the full 15-minute warm up of the x-ray machine and at times was standing in the primary beam of radiation. The manager turned on a survey meter with a few seconds left in the warm up period and the meter went off scale. Apparently, the x-ray tube had been moved into position by another department earlier in the day and a visual check of the x-ray tube failed to indicate to radiographer that the beam was pointed to the office (the incident report states office, but it is not clear if it should say control room instead). A location badge mounted on the rear wall of the office read 50 mrem and the calculated dose was 20 mrem. The incident resulted from a number of different factors, including movement of the x-ray tube, failure of a visual check to redirect the x-ray beam, failure to turn on the survey meter, and failure of the radiographer to wear his film badge and dosimeter. Aside from rule enforcement, it was suggested that a cost benefit analysis be conducted for shielding all walls in the x-ray room with a lead liner (A0057).[1]

[1] Internal Correspondence from Tuttle, R.J. and Whitebirch, W.C. to Isotopes Committee, Rockwell International, *Re: Radiation Exposure Incident – April 13, 1977*, April 19, 1977.