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

Prepared for:

EPA Contract Number: EP-S7-05-05
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LIST OF ACRONYMS AND ABBREVIATIONS

AEC	U.S. Atomic Energy Commission
AETR	Advanced Epithermal Thorium Reactor
AOC	Administrative Order on Consent
ARRA	American Recovery and Reinvestment Act
Atomics International	Atomics International Division of North American Aviation, Inc.
ATS	above ground storage tanks
μCi/cc	micro Curies per centimeter cubed
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Ci	Curie
COC	Contaminants of Concern
cpm	counts per minute
D&D	decontamination and decommissioning
DHS	Department of Health Services
DOE	Department of Energy
dpm/100 cm^2	disintegrations per minute per 100 centimeters squared
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
ESSAP	Environmental Survey and Site Assessment Program
ETEC	Energy Technology Engineering Center
FCEL	Fast Critical Experiment Laboratory
FHM	fuel handling machine
ft^2	square feet
HEPA	high-efficiency particulate air
HGL	HydroGeoLogic, Inc.
HP	Health Physicist
HSA	Historical Site Assessment
kW	kilowatt
LMEC	Liquid Metal Engineering Center
μR/hr	micro roentgen per hour
mR/hr	milli roentgen per hour
mrad/hr	millirad per hour
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	minimum detectable activity
mrem	Milli Roentgen Equivalent in Man
MWd	megawatts day
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone

NDA	no detectable activity
NRC	Nuclear Regulatory Commission
OMRE	Organic Moderated Reactor Experiment
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RHB	Radiological Health Branch
RMHF	Radioactive Material Handling Facility
S2DR	SNAP 2 Demonstration Reactor
S8DR	SNAP 8 Development Reactor
SBZ	Southern Buffer Zone
SCA	SNAP critical assembly
SEFOR	Southwest Experimental Fast Oxide Reactor
SETF	SNAP Environmental Test Facility
SGR	sodium graphite reactors
SHEA	Safety Health and Environmental Affairs
SNAP	Systems for Nuclear Auxiliary Power
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
Tetra Tech	Tetra Tech EM, Inc.
TM	technical memorandum
TO	task order
TRU	Transuranic

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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 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-5D. This TM, along with subsequent TMs prepared for the subareas identified in Table 1.1. Each TM has been made available in draft for review and informal comment by SSFL stakeholders and the general public. EPA responded to each comment via draft "Response to Comment" tables, which were also made available to SSFL Stakeholders. Each draft TM was edited as described in the Response to Comment tables, and these edits along with any new information made available to EPA have been compiled into EPA's official Radiological HSA for the Area IV Study Area.

The content of each TM is 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 have 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 may be revised.

1.2 GOALS AND METHODOLOGY OF THIS TM

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

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 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 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 HSA-5D. 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 have been eroded primarily from the surrounding Chatsworth and Santa Susana formations. Several geological faults cross this area.

[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.

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 utilize nuclear energy through its Atomics International (AI) Division.[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.

Table 1.2
Research Reactors Located at the Santa Susana Field Laboratory[4]

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 (SRE)	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

[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
[4] 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.

Table 1.2 (continued)
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)
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 has been 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]

Table 1.3
Criticality Test Facilities at the Santa Susana Field Laboratory[4]

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

[1] 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
[4] 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.

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 down slope to surrounding populated areas.[1] The NBZ was purchased by Rocketdyne Division of Rockwell International (Rockwell) in 1998 from the adjoining Brandeis-Bardin Institute (now known as the American Jewish University) 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 Area I and Area II, which is 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-5D

Subarea HSA-5D is approximately 71.5 acres of flat land that contained 20 buildings and 2 aboveground storage tanks (AST) over the years. It includes G, J, and K and 22nd through 24th Streets. Drainage is generally to the east along roadways and surface drainages to a 3,000,000-gallon reservoir located within SSFL. There are no ponds in this subarea. Primary radiological operations in the HSA-5D area related to the SNAP programs as well as to the Hot Laboratory and the Nuclear Material Development Laboratory. The majority of radiological operations in Subarea 5D occurred in the Hot Laboratory or the Nuclear Material Development Laboratory. The Hot Laboratory was used to examine irradiated nuclear fuel assemblies, SNAP Reactor cores, irradiated test materials, radioactive sources, and to declad irradiated plutonium bearing fuels. The Nuclear Material Development Laboratory contained a series of glove boxes which were designed to work with nuclear fuels and radioactive materials.

1.5 SITES IN HSA-5D

During the peak of operations, Subarea HSA-5D comprised 21 sites, 20 buildings and 1 site consisting of ASTs. This technical memorandum addresses each of these 21 sites within Subarea HSA-5D. Of the 21 sites, 1 was a critical facility and 6 housed operations possibly involving radioactive materials, including the Hot Laboratory and the Nuclear Development Laboratory. Of the 21 sites in Subarea HSA-5D, only 1 building and 2 ASTs remain today.

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;

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

- 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 off-site facilities. The information acquisition process is complete.

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. Numerous additional information requests have been ongoing and, on December 23, 2010, and January 11, 2010, Boeing provided numerous additional documents in response to both EPA original information requests and EPA queries of Boeing's document database for the SSFL. Upon receipt of supplemental documents from Boeing, EPA will carefully review the information and revise this TM and it recommendations for soil sampling, as appropriate.

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-5D TM, 2,146 individual documents and photographs were reviewed. The review process was conducted by first screening over 80,000 documents amassed for the project. These screening efforts produced 2,146 documents relevant to past operations at facilities within HSA-5D and were therefore determined to warrant in-depth evaluation. Each of these 2,146 relevant documents was thoroughly evaluated for information considered useful for carrying out the goals listed in Section 1.2 of this TM. In addition to screening and evaluating reports and other documents, a comprehensive aerial photograph analysis of Area IV was prepared. This analysis is provided in Appendix A of the HSA.

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;
- 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.

The interview information obtained to date relevant to this TM is depicted on the relevant Plate 1 figure. Appendix B of the HSA provides a summary of the interview process and completed interview summaries of each interview.

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;
- 1962/1963;
- 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 historical site assessment 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, 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.

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2.0 FINDINGS

This section organizes the building areas within HSA-5D according to four logical "clusters" (a.k.a. groups) based on operational characteristics and geographic locations. Plate 1 depicts the entire HSA-5D subarea and should be referenced while reading Section 2. Each HSA-5D group (discussed in Sections 2.1 through 2.4, 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-5D Group 1 are presented. HSA-5D Group 1 includes one parking lot, Parking Lot 4509.

2.1.1 Parking Lot 4509 Area

Site Description: The Parking Lot 4509 area comprises a parking lot located approximately 100 feet southeast of Building 4009, located within the boundaries of HSA-8, at the southwest corner of G and H Streets. Figures 2.1.1a through 2.1.1c provide a current photograph and the best available drawing(s) that the research team could find. Plate 1 presents a summary of all identified features for this site.

Building Features: There are no building features to report for Parking Lot 4509. Substation Building 4709 was located southwest of the parking lot. Building 4709 was a substation that serviced Building 4009, and as a result, is discussed in the TM for HSA-8.

Former Use(s): Parking Lot 4509 appears to have been mainly used for its intended purpose.[1]

Information from Interviewees: None to date.

Radiological Incident Reports: There have been no incident reports associated with Parking Lot 4509 located to date.

Current Use: Parking Lot 4509 remains in place. 2007 aerial photographs show the storage of large containers in the area, as well as evidence of some industrial activities, although the nature of these activities is unknown.[2,3]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Parking Lot 4509 have not been conducted.

Radiological Use Authorizations: None.

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 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.
[3] Channel Islands Regional GIS Collaborative (CIRGIS), 2007

Former Radiological Burial or Disposal Locations: No formal burial or disposal locations have been identified at or around Parking Lot 4509. However, as indicated in the March 2011 HSA-8 TM, until 1961, Building 4009 was connected to two septic tanks, including a 2,340-gallon septic tank on the northwest side of the building and a 6-line 300-linear-feet leach field located approximately 50 feet north of Building 4009. These were used for the disposal of sanitary and liquid wastes. Building 4009 was connected to the sewer system in 1961. Between 1961 and 1967 when OMR and sodium graphite reactors (SGR) operations ceased, the leach field was used for the disposal of liquid waste, only. In 2002, the leach field was excavated down to bedrock and removed. This area is in close proximity to Parking Lot 4509, and it is possible the parking lot was used as a staging area during the removal; however, information regarding the staging of material during the leach field removal could not be located in available documents. Additional information may become available when additional documents are received from Boeing.[1,2,3]

Aerial Photographs: Parking Lot 4509 first appears in aerial photographs in August 1959. Drainage channels are visible on the northwestern boundary of the parking lot. These drainage channels originate from the northwest corner of the parking lot and flow southwest to an escarpment southwest of Building 4009. The parking lot remains relatively unchanged until 1980 when drainage appears to flow northeast along the northwest boundary of the parking lot to G Street and then east along G Street. The storage of large containers appears in 2005 aerial photographs. 2007 aerial photographs show as many as 19 storage containers on the parking lot. There also appear to be other storage activities at and around the parking lot.[4]

Radionuclides of Concern: There are no radionuclides of concern associated with the parking lot; however, Building 4009, located northeast of Parking Lot 4509, used enriched uranium and thorium as reactor fuels during reactor operations. In addition, a Van de Graaff accelerator was housed in the SGR graphite storage area during the early 1960s. In the 1980s, the Organic Moderated Reactor high bay was later used for High-Energy Rate Forging, which included the handling of highly enriched uranium. While these operations did not occur at the Parking Lot 4509 area, there is no information to indicate that the Parking Lot 4509 was not used for staging purposes for Building 4009. As a result, the research team cannot conclude that potential radionuclides of concern at Building 4009 did not migrate to the Parking Lot 4509 area. Decay products from U-235, U-238, and Th-232 decay chains include Th-234, Th-228, actinium-228 (Ac-228), radium-226 (Ra-226), lead-214 (Pb-214), bismuth-214 (Bi-214), Pb-212, Bi212, and thallium-208 (Tl-208). In addition, H-3, Sr-90 and Cs-137, Na-24, Co-57, Co-60, europium-152 (Eu-152), and americium-243 (Am-243) would have been formed.[5] All radionuclides of concern listed, with the exception of Na-24 and Co-57 (due to relatively short half-lives), are included in the August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

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[1] ICF Kaiser Engineers, *Current Conditions Report and Draft RCRA Facility Investigation Work Plan: Volume 1*, October 1993, pp. 4-84, 4-87.
[2] Montgomery Watson Harza, *DOE Leach Fields (Area IV AOC) RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Draft*, October 2003, pp. 2-2, 3-4.
[3] Montgomery Watson Harza, *Group 8—Western Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory*, *Ventura County, California, Volume 1-Test*, *Tables, and Figures*, September 2007, p. 3-3.
[4] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[5] Chapman, J. A., *Radiological Survey of Building T009*, Energy Technology Engineering Center Report No. GEN-ZR-0014, August 26, 1988, pp. 10, 66, 97.

Drainage Pathways: Currently surface water in the vicinity of Parking Lot 4509 flows to the northwest, north, and northeast across the site. The northwestern boundary of the parking lot is bordered by an asphalt lined drainage channel that is associated with Building 4009. To the north-northeast is a ditch that runs east along the south side of G Street. All surface water originating from Parking Lot 4509 eventually drains into the ditch on the south side of G Street and flows east, into Area III.

Historical aerial photographs initially show the flow to be to the southwest to an escarpment southwest of Building 4009. In 1980, the flow appears to have been directed northeast along the northwest boundary of the parking lot to G Street and then east along G Street. The northeast drainage pattern is also depicted in a 1969 plot plan of the site.[1,2]

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Parking Lot 4509 area is Class 2 because of the unknown nature of current storage activities on the site and the proximity of the parking lot to Building 4009, discussed in TM HSA-8.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.1 provide a convenient reference for the following recommendations.

Characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Parking Lot 4509 area. It is recommended the characterization be included with the sampling plan identified for HSA-8.

- The perimeter of the former Parking Lot 4509, including the drainage channel located northwest of the parking lot. Residual contamination above the levels consistent with the DTSC/DOE December 2010 AOC may be present as a result of radioactive materials draining from facilities associated with Building 4009 to the northwest to the parking lot. Also, industrial activities at the parking lot may have included radioactive materials, including any staging during removal of the Building 4009 leach field or underground radioactive waste holdup tanks.

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-5D Group 2 are presented. HSA-5D Group 2 includes six building areas including Building 4020, the Hot Laboratory, Building 4468, the waste storage tank building for the Hot Laboratory, Building 4055, the Nuclear Materials Development Facility, Building 4373, the first SNAP critical facility, and Building 4374, a NaK loop building that supported Building 4373. This area also includes a suspected pond dredge area for which no information has been located, to date, and an unknown building that appears in aerial photographs in 1988 and has been removed prior to 2005.

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] Atomics International, Santa Susana Facility Plot Plan Drawing 303-GEN-C45, Sheet 11 of 14, February 21, 1969.

2.2.1 Building 4020 Area

Site Description: The Building 4020 area includes Building 4020, Building 4323 (a guard building), and Building 4720 (a substation) and the surrounding area. Constructed in 1959, Building 4020, the Hot Laboratory, formerly the Component Development Hot Cell, was constructed for the remote handling and examination of highly radioactive materials.[1] The building was a below- and above-ground structure comprising approximately 16,000 square feet. Other buildings within the vicinity of Building 4020 included Building 4468, discussed below in Section 2.2.2. Figures 2.2.1a through 2.2.1t provide a current photograph and the best available building-specific drawing(s) and photographs that the research team could find. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4020, comprising approximately 16,000 square feet, was constructed of both reinforced normal and dense concrete. The building included a main level, as well as a basement and an attic. The basement included three sumps, while the attic included utility plumbing and piping.[2] Figure 2.2.1b provides an elevation view of Building 4020. The basement of Building 4020 was constructed of 24-inch thick concrete walls. The basement structure included five large concrete support columns that provided part of the structural support for the hot cells (see Figure 2.2.1d). A carbon-steel pipe storage tube was embedded in the center of Columns 1, 2, 3, and 5, extending vertically downward from the hot cell floor to a distance of approximately 12 feet. The three sumps in the basement were provided in support of the drain subsystem. During initial construction, the facility radioactive drain was connected to two 500-gallon holdup tanks that were located in the north end of the basement. One of the tanks was designed for high-level waste and the other for low-level waste.[3] Following an incident whereby these tanks overflowed, the system was modified by installing a 3,000-gallon tank in Building 4468 in around 1970, and removing the 500-gallon tanks in 1977. After the new system had been put into place, the contents of these sumps were pumped into the Building 4468 holdup tank, discussed below (see Figure 2.2.1e).[4,5,6]

[redacted][7,8] The operations support facilities included a hot storage room (Room 153), air lock (Room 155), hot laboratory (Room 141), manipulator maintenance room (Room 128), and glove box laboratory (Room 139).[9]

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[1] Boeing, Document No. RS-00010, *Area 4020, MARSSIM Final Status Survey Report*, October 31, 2000.
[2] Rockwell International, Document No. RI/RD90-118P, *Decontamination and Decommissioning of Hot Laboratory, Building 020 SS, Volume 1, Technical Proposal for Complication of Task*, March 31, 1990.
[3] Source documents do not provide additional information to indicate whether the high-level waste is what is more traditionally defined as "HLW." Source documents also do not provide information to indicate the level of radioactivity in the waste.
[4] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[5] Boeing, Document No. RS-00010, *Area 4020 MARSSIM Final Status Survey Report*, October 31, 2000.
[6] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Occurrence – Bldg T020*, October 3, 1977.
[7] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[8] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[9] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.

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[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[3] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[4] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[5] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[6] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[7] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[8] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.

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Building 4020 was reported to have been equipped to handle a large variety of radioactive materials shipping casks. In one instance, the Piqua fuel transfer cask weighed 40,000 pounds and was loaded and unloaded using the cask handling docks at Building 4020. The cask would then have been brought into the decontamination room, unloaded and the various materials would have entered the cells through the large doors between the decontamination room and hot cells. Smaller casks were reportedly placed into the hot cells with an electric fork truck by moving the casks into the cells through the service gallery. Once within the cells, small components from each cask, if required, would have been transferred from cell to cell through the transfer drawers described above. Figure 2.2.1h shows Piqua Fuel Element handling cask and more typical S8ER core cask that were handled at Building 4020.[3]

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[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[3] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.

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[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[3] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[4] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[5] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[6] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[7] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

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[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[3] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[4] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[5] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[6] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

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According to March 1990, technical proposal for the decontamination and decommissioning of Building 4020, two alpha boxes were installed in the Hot Shop, Room 139, for the handling of small quantities of contaminated materials. The alpha box atmospheres were maintained at negative pressure with respect to Room 139 using an independent pressure control system. The box atmosphere exited the alpha box through a series of three HEPA filters and a redundant blower system before entering the facility stack.[5]

As indicated above, during initial construction, the facility radioactive drain was connected to two 500-gallon holdup tanks that were located in the north end of the basement. One of the tanks was designed for high-level waste and the other for low-level waste. According to the final decontamination and dismantlement report for Building 4020, following an incident whereby these tanks overflowed, the system was modified in approximately 1970 by installing a 3,000-gallon tank in Building 4468 and removing the 500-gallon tanks. The date of the incident causing the installation of the 3,000-gallon tank is unknown; however, a September 1977 incident report indicated that the old radioactive liquid waste tanks were being prepared for removal from the basement of Building 4020. Building 4468 was located to the east of the Hot Laboratory at the perimeter fence line.[6,7,8]

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[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[3] Rockwell International, 82ESG-224 Enclosure, *Energy Systems Group Effluent Monitoring Report, Special Nuclear Material License SNM-21*, Date unknown.
[4] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[5] Rockwell International, Document No. RI/RD90-118P, *Decontamination and Decommissioning of Hot Laboratory, Building 020 SS, Volume 1, Technical Proposal for Complication of Task*, March 31, 1990.
[6] Boeing, Document No. RS-00010, *Area 402 MARSSIM Final Status Survey Report*, October 31, 2000.
[7] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[8] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Occurrence – Bldg T020*, October 3, 1977.

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According to the 2000 verification survey, two underground fission gas tanks were located on the north end of the building; however, a March 1999 technical proposal for the decontamination and decommissioning of the building indicates there were three underground tanks for the fission gas system, which are also indicated in building facility drawings (see Figure 2.2.1k).[8] According to the description provided in that document, the fission gas system consisted of plumbing from the cells, through the basement, through a control pit north of the building and

[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[3] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[4] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[5] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[6] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[7] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[8] Atomics International, Drawing No. A-3-4213, Components Development Hot Cell Yard Piping Plan, Date Illegible.

into three underground gas tanks located north of the facility. According to the survey report and final decontamination and decommissioning report, the tanks were never put into service.[1,2]

In addition to the facilities located inside the building, a loading dock and holdup yard were located on the west side of the building and a concrete pad was located at the north end of the building.[3] Temporary office and health physics office trailers were also located within the facility boundary at various times.[4] Aerial photographs show the presence of a trailer on the east side of the building between Buildings 4020 and 4468. The building, upon construction, was also connected to two septic tanks and a leach field upon construction. The leach field manhole detail in facility drawings show the leach field to have been lined with gravel. The leach field included a drain line that exited from the east along 24th street through a 1 1/2-inch drain to a ditch (see Figures 2.2.1l and 2.2.1m).[56] However, the MARSSIM final status survey report indicated that these facilities were never used and the building was connected to the Area III sewage treatment plant around 1960.[7] The leach field and septic systems were removed in 1997 along with the removal of the liquid waste facility, Building 4468, discussed in Section 2.2.2 below. The building also included a 5,000-gallon underground diesel storage tank that was installed in 1959 and removed on August 3, 1989.[8]

The building stack was located on the north side of the building. Based on available facility drawings, it appears the stack was located adjacent to a manhole that contained gravel at the bottom and included six 3-inch pipe sleeves. The purpose of this manhole is unknown; however, a review of the available documents within Boeing's 1.4 million document database may provide additional information regarding this manhole (see Figure 2.2.1n).[9]

Former Use(s): Constructed in 1959, Building 4020, the Hot Laboratory, formerly the Component Development Hot Cell, was constructed for the remote handling and examination of highly radioactive materials.[10] Building 4020 was used for the examination and evaluation of reactor fuels and components, and in irradiation test materials. This included Sodium Reactor Experiment (SRE) fuel assemblies and moderator cans, fuel elements from the Ohio Piqua Nuclear Power Facility and the Organic Moderated Reactor Experiment reactors, and fuel test capsules irradiated at the Materials Testing, Engineering Test, General Electric Testing, "HWOCS," and Hanford reactors. Irradiated fuel test capsules, based on available documents, appear to have been used in experiments to verify predicted release rates and disposition of

[1] ORISE, Document No. ORISE 2000-1524, *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, December 2000.
[2] Rockwell International, Document No. RI/RD90-118P, *Decontamination and Decommissioning of Hot Laboratory, Building 020 SS, Volume 1, Technical Proposal for Complication of Task*, March 31, 1990.
[3] ORISE, Document No. ORISE 2000-1524, *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, December 2000.
[4] Boeing, Document No. EID-06141, *Hot Laboratory Decontamination and Dismantlement Final Report*, November 27, 2001.
[5] Atomics International, Drawing No. 303-020-P17, Building 020 Santa Susana Facility, Breathing Air Supply, Date Illegible.
[6] Atomics International, Drawing No. A-3-4213, components Development Hot Cell Yard Piping Plan, Date Illegible.
[7] Boeing, Document No. RS-00010, *Area 4020, MARSSIM Final Status Survey Report*, October 31, 2000.
[8] Rockwell International, Document No. RI/RD90-132, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites, 1989*, May 1990.
[9] Atomics International, Drawing A3-7810, CDHC Building Foundation Details, Date Illegible.
[10] Boeing, Document No. RS-00010, *Area 4020, MARSSIM Final Status Survey Report*, October 31, 2000.

fission products from vented fuel elements. These capsules required disassembly at Building 4020, similar to fuel rods, to remove radioactive material. An April 13, 1971, internal letter documents the preparation of Building 4020 for the acceptance and disassembly of an "URIPS-1P-RTG" from Aerojet-General Nuclear Company. The fuel for the RTG was documented to be a capsule containing 7,700 Ci of Sr-90.[12] At an unknown date, the entire SNAP 8 Experimental Reactor core, containing 211 fuel elements, was disassembled and examined at Building 4020. The SNAP 10FS3 reactor, including the vessel, core, primary pump, and piping, was also disassembled and examined at the Hot Laboratory. During disassembly of these components, typical tests included torque measurements, spring constant measurements, and bearing quality tests.[3,4]

The Hot Laboratory was also used for the disassembly and examination of Systems for Nuclear Auxiliary Power (SNAP) Reactor cores, the analysis of irradiated test materials, the manufacture and leak testing of sealed radioactive sources (primarily Pm-147), and the machining of radioactive Co-60.[5,6,7]

In 1976, the operations in Building 4020 involved the preparation of irradiated SRE fuel for eventual reprocessing by removal of the metal cladding and thermal bonding material, cleaning and repackaging of the fuel slugs and shipping the fuel for reprocessing.[8] Core I fuel consisted of low-enrichment uranium metal, clad with stainless steel and NaK bonded. Core II fuel consisted of thorium-uranium alloy with highly enriched uranium, clad with stainless steel and NaK bonded. Additionally, several miscellaneous SRE test elements were being prepared for processing. According to the 1976 environmental impact assessment, the majority of the irradiated fuel was stored in element form in special storage cans. Each fuel element consisted of five to seven fuel rods and each rod was made up of several fuel slugs clad in a stainless steel sheath and thermally bonded with NaK. [9]

At the disassembly station in Cell 3 of Building 4020, the fuel elements were removed from the fuel cans and disassembled. The disassembled fuel rod was transferred to a washing tank to remove any external residual Na or NaK. Residual Na or NaK on the surface of the elements was removed by reacting it in a solution of Dowanol. The fuel slugs were pushed out of the cladding tubes and washed, again with Dowanol, to remove any residual NaK. The fuel slugs were further cleaned by brushing with alcohol and immersing in an ultrasonic tank. The 1976

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[1] Atomics International, Document No. NAA-SR-9469, *Project Proposals Fiscal Years 1965 and 1966, Sodium Cooled Reactor Development Programs*¸ November 2, 1964.
[2] Heine, W.F., North American Rockwell Internal Letter Re: Operational Safety Unit Weekly Highlights – Week Ending 4/9/71, April 13, 1971.
[3] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[4] ORISE, Document No. ORISE 2000-1524, *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, December 2000.
[5] Vandiver, D.B., Letter Re: Nuclear Hazards Indemnity, July 10, 1986, and DuVal, R., Letter Re: Removal of 12 WESF Capsules from RIHL," undated.
[6] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[7] Boeing, Document No. EID-06141, *Hot Laboratory Decontamination and Dismantlement Final Report*, November 27, 2001.
[8] Rockwell International, AI-76-21, *Environmental Impact Assessment of Operations at Atomics International Under Special Nuclear Materials License No. SNM-21*, April 30, 1976.
[9] Rockwell International, AI-76-21, *Environmental Impact Assessment of Operations at Atomics International Under Special Nuclear Materials License No. SNM-21*, April 30, 1976.

assessment did not identify the location of the ultrasonic tank referenced.[1] Dowanol is a trade name for ethylene glycol n-butyl ether (99%) and was found to be effective for the removal of sodium and NaK from components by reaction.[2] Its use at the SSFL for the removal of sodium is documented in documents as early as 1965.[3]

The clean fuel slugs from a maximum of two fuel elements were then transferred into a shipping canister and the lid was welded on. The shipping canister was then returned to the SRE fuel storage vault.[4] The environmental impact assessment noted that the radioactive materials that were handled in encapsulated or uncapsulated form contained the following uranium isotopes: U-234, U-235, U-236, and U-238, thorium, Cs-137, Sr-90-Y-90, Kr-85, and Pm-147 as mixed fission products.[5]

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[1] Rockwell International, AI-76-21, *Environmental Impact Assessment of Operations at Atomics International Under Special Nuclear Materials License No. SNM-21*, April 30, 1976.
[2] Energy Technology Engineering Center Document No. A4CM-AR-0005, *Area IV Chemical Usage Summary Report*, September 30, 1994.
[3] Atomics International, NAA-SR-MEMO-11605, *Weekly Hightlights for S8ER Operations Week Ending August 21, 1965*, August 27, 1965.
[4] Later in the document, the environmental impact assessment stated the canistered slugs were stored at the RMHF until ready for shipment to Savannah River.
[5] Rockwell International, AI-76-21, *Environmental Impact Assessment of Operations at Atomics International Under Special Nuclear Materials License No. SNM-21*, April 30, 1976.
[6] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

[redacted]

According to an undated document, personnel in Building 4020 were responsible for the maintenance and repair of the manipulators and the in-cell equipment to ensure maximum hot cell availability at all times. Control of the radioactive contamination level in the hot cells was maintained by periodic cleaning to permit cell entries without excessive personnel radiation exposure. The document did not indicate how frequently the cells were cleaned, the methods used to clean the cells, or the methods to dispose waste products created by the fuel cell cleaning operations.[1] However, the 2001 final decontamination and decommissioning report indicated that it was standard practice during building operations to decontaminate and clean the facility "as well as practical" at the end of each program. According to the report, all project-related equipment and materials used in the complete program were removed and either surplused or disposed of as radioactive waste. The cells and decontamination rooms were washed down and the gross contamination was removed in preparation for the next program.[2]

[redacted][4]

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[1] Atomics International, *Atomics International Hot Laboratory Capabilities and Facilities*, Date Unknown.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[3] According to available information on the internet, Hastelloy is the registered trademark name of Haynes International, Inc. The trademark is applied as the prefix name of a range of twenty two different highly corrosion-resistant metal alloys loosely grouped by the metallurgical industry under the material term "superalloys" or "high-performance alloys."
[4] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

[redacted][1]

Following the termination of the SNAP program, Building 4020 was used for the decladding of irradiated plutonium-bearing fuels from SRE and off-site reactors. The decladding operations included the disassembly of fuel assemblies, removal of the fuel from its cladding, size-reduction of the non-fuel components, and shipment off-site of the separated materials. These operations were performed for fuels from the SRE, Hallam Reactor, Experimental Breeder Reactor I (EBR-I), Experimental Breeder Reactor II (EBR-II), Southwest Experiment Fast Oxide Reactor (SEFOR), and the Fermi Reactor. These operations continued for a period of approximately ten years, immediately prior to the facility shutdown.[2]

[redacted]

[redacted]

[redacted]

[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Boeing, Document No. EID-06141, *Hot Laboratory Decontamination and Dismantlement Final Report*, November 27, 2001.

[redacted]

[redacted]

[redacted][1]

[redacted][2,3,4]

[redacted][5][1]

[1] Atomics International, Facility Review of Historical MUF, Appendix A, Date unknown.
[2] Rockwell International, ESG81-30, *Onsite Radiological Contingency Plan for Rockwell International Operations Licensed Under Special Nuclear Material License No. SNM-21*, March 3, 1982.
[3] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[4] Rockwell International, Enclosure 2 to 87RC02380, *Rockwell Division, Rockwell International, Transuranic Waste Handling and Packaging Plan*, February 27, 1987.
[5] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

In addition to the decladding operations, in 1986, twelve DOE-owned Cs-137 capsules were transported from Building 4020 to the Gamma Irradiation Facility in Canoga Park, California.[2]

The final decladding program performed in Building 4020 was related to Fermi program. According to the 2001 final decontamination and decommissioning report, the Fermi program was completed ahead of schedule and all equipment and materials related to the decladding project were removed and the cells decontaminated in 1986 in preparation for another project. However, the DOE decided to begin decommissioning and demolition of the facility, rather than continuing operations. DOE assumed responsibility for the decontamination and decommissioning of Building 4020 as a result of the building's use in support of DOE programs. As such, the decommissioning was conducted under Special Nuclear Material License No. SNM-21.[3]

Between 1987 and 1991 all hazardous materials and equipment not related to decommissioning and demolition were removed. Decontamination efforts focused on the removal of general contamination from support areas, decontamination rooms and hot cells. According to the 2000 Oak Ridge Institute for Science and Education (ORISE) verification survey, areas of modest contamination, due to spills and container leakage, were detected on the exterior of Building 4020 at the loading dock and holdup yard to the west of the building, as well as the concrete pad located on the north end of the building.[4,5] These areas were to be decontaminated with the removal of asphalt, concrete and dirt as indicated by the results of radiation surveys. Figure 2.2.1o presents the projected radioactive contamination located at and around Building 4020 as presented in a March 1990 technical proposal for the decontamination and decommissioning of Building 4020.[6]

In 1992, activities in Building 4020 transitioned from decontamination to demolition; however, decontamination continued from 1992 through 1995 in support of demolition activities. Prior to final demolition, ownership of the facility transferred from Rocketdyne to DOE in October 1995. Concurrent with the transfer of ownership, Rocketdyne requested the termination of the NRC license, which was granted on October 3, 1996, with the condition that Rocketdyne and the DOE complete decontamination and release of the facility in compliance with NRC guidelines.[7]

By 1996, the above-ground structure was completely removed. These demolition operations are discussed in detail in the final decontamination and dismantlement report and are not discussed in this TM. Of greater interest are the demolition activities of the basement structure, which was below-ground and had the most direct contact with surrounding soils. The following provides a

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[1] Schaubert, V. and Allen, D., *Special Nuclear Material Control Program for SEFOR Fuel Decladding*, Date Unknown.

[2] Vandiver, D.B., Letter Re: Nuclear Hazards Indemnity, July 10, 1986, and DuVal, R., Letter Re: Removal of 12 WESF Capsules from RIHL," undated.

[3] Boeing, Document No. EID-06141, *Hot Laboratory Decontamination and Dismantlement Final Report,* November 27, 2001.

[4] Boeing, Document No. EID-06141, *Hot Laboratory Decontamination and Dismantlement Final Report,* November 27, 2001.

[5] ORISE, Document No. ORISE 2000-1524, *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, December 2000.

[6] Rockwell International, Document No. RI/RD90-118P, *Decontamination and Decommissioning of Hot Laboratory, Building 020 SS, Volume 1, Technical Proposal for Complication of Task*, March 31, 1990.

[7] Boeing, Document No. EID-06141, *Hot Laboratory Decontamination and Dismantlement Final Report*, November 27, 2001.

detailed summary of the Building 4020 basement demolition as presented in the 2000 Final Decontamination and Dismantlement Report.

During Fiscal Year 1997, the demolition activities of Building 4020 focused on the removal of the basement structure. According to the final report, the first step in removing the basement was the decontamination of the basement interior surfaces to a level that would allow the saw cutting and removal of the concrete basement roof, walls, and floor with a minimum of radiological contamination concerns. As a result, all basement surfaces were washed down with a high-pressure water spray. The resultant waste water was collected in the three basement sumps and was transferred to the RMHF in a 500-gallon portable transfer tank for evaporation.[1]

Following the wash down, personnel completed a radiological survey for the basement interior surfaces and radiologically contaminated spots were identified and marked. The three basement sumps were drained, the sludge was removed, and the sumps were painted to fix all loose contamination. The floor drains were plugged or sealed with flanges to isolate the higher levels of contamination remaining within the underlying drain lines.

Decontamination of the floor area within the basement was performed using a pneumatic floor scabbler. Scabbling operations concentrated on the known hot spots, including specific floor sections and areas around sumps and drain openings. During the course of rains in late 1996 and early 1997, approximately 6,500 gallons of rain water had to be pumped from the basement as a result of infiltration through a specially constructed wooden structure that was constructed to prevent rain from entering the basement structure. The final report did not indicate how this water was managed or disposed of or if any of it overflowed or escaped the open structure.

In November 1996 work began on the saw-cutting of the floor slab of the former office and support areas, which were outside the basement area. Following the rainy season, the cut slab sections were removed, numbered, and stacked in the south parking lot of the facility for storage where the slabs were to be surveyed and prepared for disposal. According to the Boeing report, the exposed soil was surveyed and any detectable contamination was removed. EPA cannot independently confirm or deny conclusions regarding such past contamination efforts that were not under EPA oversight. The report did not provide information to indicate contaminant levels or how much soil in this area was found to be contaminated and removed.[2] Potential runoff from this parking lot where concrete slabs were stored would have flowed east under 24th street and into a drainage ditch along the south side of J Street.

Following the removal of the concrete slabs surrounding the basement area, excavation around the support foundation walls were begun. According to the final report, an objective of the basement demolition was to reuse the soil that was excavated from around the basement walls to fill in the excavation once the area had been released. Photographs of the demolition activities show the soil to have been stock-piled around the work area (see Figure 2.2.1p). Detailed radiological surveys of the surrounding areas were performed prior to the excavation of the foundation and three areas with significant contamination were located; however the report did not provide the analytical results of these surveys or if these three areas were cleaned up. These three areas included the vicinity of the waste-water transfer station on the west side of Building 4468. Approximately 30 cubic yards of contaminated soil was removed from this area prior to

[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.

the excavation of the basement. The source of contamination was determined to have been an underground 2-inch diameter pipe that was used to transfer contaminated waste water from the facility 3,000-gallon drain tank to the 500-gallon portable transfer tank loading station.[1] Drainage from these soil stockpile areas would have flowed east into the drainage ditch along the south side of J Street or into the drainage along the south side of G Street.

Another area of contaminated soil was located in a seam between two concrete slabs in the service gallery area, adjacent to Cells 1 and 2. Contamination in the seam area was reported to have been fixed previously to prevent contamination from migrating. Upon removal of the foundation and floor slab, it was discovered that the seam between the slabs had separated and was open to the underlying soil. According to an interviewee, the cracks in the floor were likely caused by the extensive and aggressive decontamination of the floors and the concrete "couldn't take it." The interviewee also stated that the roof leaked severely in some areas and rainwater problems were big concerns in part of the building. Contaminated water from routine cleaning of the area during facility operations migrated through this seam and into the "top few inches of soil." According to the report, construction seams in the floors or at wall-floor joints were the major source of contamination in the soil beneath the Building 4020 slab.[2][3]

The final area of radiologically contaminated soil was found in a seam between the north cell wall and the floor below the Cell 4 fuel transfer port. During normal facility operations, fuel transfer casks were mated to the port for fuel package transfer into the cell. Contaminated water from the fuel transfer casks, and from facility decontamination activities, leaked through the seam. Approximately 4 cubic yards of contaminated soil were excavated from this area. The contaminated soils were removed from all three areas, and were surveyed and "free-released" by Rockwell International's Radiation Safety.[4]

Following the removal of contaminated soil surrounding Building 4020, the basement roof (24 inches thick) was sectioned by a combination of core drilling, circular saw cutting, and wire saw cutting. The final report stated that all concrete coring and cutting was preceded by surveying and decontamination of the cutting path in order to minimize the generation of contaminated dust or cooling water. Cutting wastewater was generated during these operations and accumulated in the basement sumps. The waste water was pumped from the basement sumps into ground-level portable holding tanks where solids were allowed to settle out. The tanks were then transferred to the RMHF. Concrete rubble that was generated was packaged for disposal as radioactive waste. A large excavator lifted the sections of cut concrete and transported them to the staging area.[5]

Following the removal of the basement roof, and the excavation of the soil adjacent to the exterior of the basement wall, the contractor began saw cutting the basement walls. The walls were cut into 15-foot high by 30-inch wide sections after being surveyed by Rockwell International's Radiation Safety. The cuts were made from the interior of the basement and cut depth was set at approximately ¼ inch less than the thickness of the wall to attempt to eliminate the potential for the spread of radiological contamination from the saw blade cooling water

[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[3] Dempsey, Gregg, Email to Craig Cooper (EPA), April 6, 2011
[4] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[5] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.

spray. The contractor was also instructed to leave approximately 4 inches of wall at the base to act as a barrier to hold contaminated water inside the basement. Following the cutting of the sections, each section was snapped off by an excavator and transported to a holding area for a detailed survey and decontamination by ETEC. The report did not indicate whether the Building 4020 parking lot was the holding area for the basement wall sections.[1]

The large high-density concrete support columns were also sectioned, size-reduced, and removed from the basement. The personnel entry tunnel at the southeast corner of the based was also excavated and cut into sections in the same manner as the basement wall sections. According to the report, the cutting of the east basement wall was complicated by the presence of the 2-foot diameter and 30-foot long utility tunnel that connected the basement with Building 4468. Each section of this tunnel was surveyed prior to being demolished. The waste material from these activities was placed in a roll-off container.[2]

The final report indicated that all waste water and cutting slurry generated during the cutting operations was captured in approved radiological shipping containers and sampled for contamination. The Boeing report indicated that radiologically clean water was held for approximately 2 days to allow the solids to settle out and the water was pumped to a holding tank, re-sampled to verify it was free of contamination, and released into the site sanitary water system. EPA cannot independently confirm or deny conclusions regarding such past decontamination efforts that were not under EPA oversight. The residual concrete slurry was allowed to dry in the shipping containers and was transferred to the RMHF for off-site disposal. Contaminated water was separated from the concrete fines and transferred to the RMHF and was processed through the facility liquid waste handling system.[3]

The final stage of basement demolition included the removal of the floor drains and the concrete floor slab. According to the final report, the floor drains were the largest potential source of radiological contamination and source of the highest exposure levels in the basement. Following the removal of the walls, ETEC personnel saw-cut 18-inch wide trenches in the floor to expose the drainage system beneath the concrete slab. Radiation Safety personnel monitored exposure levels as segments of the underlying drain line system were exposed. As it was removed, the drain line was sectioned, the section ends were sealed, and the sealed components were transferred to the RMHF in standard waste containers for clean out and isotopic analysis; however, the final report did not provide the results of this analysis.[4]

After the removal of the drain system from the basement area, the remaining floor slab was surveyed and additional areas were decontaminated; however, the method of decontamination was not documented in the report. Following decontamination, the slab was saw-cut into sections with an emphasis on the containment of the saw-cutting water to avoid the potential spread of contamination. According to the final report, approximately 3,500 gallons of waste water was generated in a typical week of horizontal saw cutting of thick concrete. The report did not indicate the duration of these activities or how the waste water was managed.[5]

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[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[3] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[4] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[5] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.

The basement slab sections in the tunnel area were removed by a large excavator. As stated in the report, the first slabs removed were washed down in a "large tub" to remove loose contamination. However, the procedure was determined to be too time consuming and the subsequent slab sections were set aside for later decontamination although where the slabs were placed was not documented in the report.[1]

It was found that the basement slab sections in the area of the five support columns were 3 to 4 feet thick instead of the 2 feet specified in the as-built facility drawings and could not be removed similarly to other sections of the slab as a result of the increased thickness. According to the report, an excavator with a large hi-ram was ultimately used to reduce the final 30 percent of the slab area to rubble. The resulting concrete and steel debris was placed in roll-off containers and waste boxes for disposal as low-level radioactive waste.[2]

According to the report, the demolition of the facility basement was completed at the end of Fiscal Year 1997. Figure 2.2.1q provides a view of the resulting excavation. Final radiological surveys of the excavation and the surrounding site area by Rocketdyne Radiation Safety personnel were performed in parallel with the basement removal, and included the collection and analysis of soil samples. As a result, the excavated area was verified by Rocketdyne to be radiologically clean at the end of Fiscal Year 1997, as well.[3]

The Fiscal Year 1998 activities included the final verification surveys of the excavated Building 4020 basement area, as well as the removal of the liquid waste facility and the leach field/septic tank system. The removal of the liquid waste facility is described in Section 2.2.2, below. The soil above and surrounding the septic tank and leach pits were excavate din 2-foot depth increments, with radiological surveys and soil samples taken at each level. According to the final decontamination and dismantlement report, all of the soil from this excavation process was determined to be radiologically clean. The septic tank was found to be backfilled with soil, which was believed to have been done when the septic tank system was bypassed to connect the facility to the site sanitation system. The septic tank was sampled, pulled from its location, "demolished" and placed into a roll-off container for disposal. According to Boeing, the final report stated that the septic tank was "free of radiological contamination and any hazardous biological materials.[4]

Each of the two leach pits comprised a cylindrical brick structure that was surrounded by gravel and had a gravel layer on the inside bottom. The final decontamination and dismantlement report indicated that "extensive surveys were made during excavation" and both pits were determined to be "free of radiological contamination and biological hazards. The bricks from the pits were placed in roll-off containers for disposal as clean waste. The report did not indicate where the bricks or septic tank pieces were ultimately disposed of. Rocketdyne Radiation Safety personnel performed a final release survey of the septic tank and leach pit excavations.[5]

The final verification surveys were completed by ORISE and the California Department of Health Services Radiological Branch. ORISE issued a written report in January 1998 indicating

[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[3] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[4] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[5] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.

that the excavated area was radiologically clean. However, only the Rocketdyne test results and a verbal confirmation from ORISE were used to make a "programmatic" decision to backfill the excavation prior to the release of the official ORISE report in order to avoid the presence of an open pit during the winter rainy season.[1]

The excavation was first lined with a 1-foot thick layer of sand as marker to identify the bottom of the excavation. The area was then backfilled and compacted during the first quarter of fiscal year 1998. Figure 2.2.1r show the beginning of the backfilling operation and the site at completion, respectively. As seen in Figure 2.2.1r, the storage of concrete block sections from the basement demolition activities are visible on the parking lot, Parking Lot 4520, located south of the former Building 4020 location.[2]

During the first quarter of fiscal year 2000, ORISE and the California DHS performed final release surveys of the entire backfilled and graded site, including the leach field, septic tanks, and waste storage tank. Rocketdyne completed a final status survey report in October 2000.[3]

Information from Interviewee: A number of interviewees had experience with the operations in Building 4020. A summary of the information provided from these interviewees is presented below.

Interviewee 3 worked for Atomics International for 35 years (1963-1999) as a forklift operator, plutonium facility worker, and operations engineer. The following excerpts were pulled from the interview:

> *"Buildings 20, 21, 22, 24, 25, 19, 59, 9, and 100 were all hot buildings."*
>
> *"I went in the hot cell with the fork lift to take out the windows. They were very long and stair stepped with lead-impregnated quartz glass, white oil, then another layer of lead-impregnated quartz glass. Those windows weighed 6,000 pounds. There was not much room to drive around in there. They were changing the seals on the windows and that's why I was hauling the windows around. The seals would deteriorate from exposure to the radiation. They had all kinds of stuff in that building like iridium and tritium."*
>
> *"As far as the plutonium facility, they went hot with plutonium, but when I was there I was just helping build the building. I never heard of any problems there after it went hot."*

Interviewee 4 worked for Rocketdyne in the 1960's and again in the early 1990's. . The following excerpt was pull from the interview.

> *"I developed instructions for decontamination and decommissioning operations for the Hot Lab. I prepared the lab to be torn down and was responsible for cleaning the Hot Lab. I think that waste was shipped from the Hot Lab to another facility and then shipped off site for disposal. I don't remember where that temporary storage facility was located since that wasn't my responsibility. Perhaps the waste was stored temporarily at the*

[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[3] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.

Sodium Reactor Experiment (SRE). I think there was a concrete pad outside the Hot Lab for staging drums."

Interviewee 106 started working at Santa Susana in 1954 eventually becoming a Senior Research Mechanic who had extensive knowledge of the Hot Lab (Building 020), the Engineering Test Building (Building 003), the hot cell and the SRE.

"I also fabricated plutonium into fuel rods. At one time I had enough materials in my safe to make four bombs. I had to balance the radioactive materials every night to 1 gram."

"As far as materials handling and disposal we had people who took care of that stuff. I did develop a cleaning technique to clean oil from ones hands so that it wouldn't be transferred to the fuel elements that involved using ethyl alcohol or acetone and a triple set of gloves. But the oil would still show up on the fuel. We also stored the uranium and plutonium fuel in birdcages so that there would be no interaction between them. A maximum of one birdcage could be carried on a truck. We couldn't stack them together or they would go critical."

As an expert high temperature stress analyst and an expert on high temperature sodium facilities with a degree in Engineering, Interviewee 110 worked for the Atomic Energy Commission at Santa Susana. The following excerpts came from the interview with Interviewee 110.

"I do remember the Hot Cell in Building 20 where we examined elements from the OMRE (Organic Moderated Reactor Experiment). I designed the fuel elements or control rods for the OMRE. After action work included Hot Cell examination of the fuel elements that were shipped from Idaho to SSFL in sealed shipping casks."

"With respect to impacts to the environment, the only thing that we discharged directly into the atmosphere was non-radioactive sodium and water. Sodium oxide eventually degrades to become sodium carbonate which is just chalk. Sodium oxide is corrosive and it may have landed on a cow or two and their skin may have gotten a little irritated."

According to an interviewee (125) who worked for Atomics International in Building 20 from 1962 to 1965 as a machinist:

"We dissected the fuels that came out of the reactors in the hot cell and would run tests on them. We would take the fuel out of its casing, cut it apart, and take various measurements as our work dictated."

"There were probably a lot of little things that occurred at SSFL that were unusual, but nothing that wasn't at least anticipated at some point as being possible. For example, say you dropped a piece of fuel, you would have to stand back further maybe, reassess exposure issues, and clean it up. So if something that happened that was unplanned there were still procedures in place to deal with the situation. This was in the hot cell, so it was not in an open area. I did remote fabrication and machining of different parts at SSFL. So an unanticipated event in my work could have been dropping something from the remote manipulators onto the hot cell floor. The remedy for the situation may have involved something like moving things around and getting an overhead crane to pick up

the dropped object. The remote handlers made things more complicated and clumsy, but we had procedures to deal with unplanned events."

"Worker health was protected differently depending on the area. You had cloth masks that went over the nose as one level of protection and then a more hazardous area may call for fully sealed air supply masks with face pieces. You may wear layered clothing depending on where you were working. You may wear a lot of layers in the most hazardous area and then shed layers as you moved through sealed entryways into less hazardous areas. The clothes, such as coveralls, gloves, or boot covers would be bagged in each area and go into separate contaminated collection bins. I don't know if they had a hot laundry facility or not.[1] I don't know of any disposal of radiological material on site. Disposal occurred either in a metal drum for regular trash or a lead, steel, or concrete container built specifically for the contaminated waste. Radiological material would come into the facility in a protective container and go out in the same manner. Sometime we shipped fuel rods back out to an offsite storage facility, but I don't know where that would have been. Most of our fuel came originally from Hanford, Washington or a site in Idaho."

"I know we used trichloroethylene and acetone and probably some other chemicals at the hot cell. Chemicals were stored in metal, fire resistant containers. As far as disposal, they were all shipped out in plastic, metal, or glass containers depending on the chemical. I don't remember exactly how we disposed of chemicals. We took out whatever we had to take out and followed our established rules for that. You would monitor the waste for contamination levels and dispose as appropriate. In the hot cell, particulates would be swept up and put in the appropriate container. Damp wipes would be used as another level of cleaning, and finally you would go in with your cleaning chemicals. Contaminated solids would go into appropriate containers. Any contaminated liquid waste would go into the building's contaminated liquid waste collection system."

"Building 20 had a liquid waste collection system and a gas filtration system. I don't think anything left the building immediately. Sanitary waste went to the sewer system, but everything else went into the building's own built-in disposal system. Everything was filtered. The basement of Building 20 contained the filtration system. The hot cell and the area outside the hot cell was kept at a negative atmosphere. Air would be sucked into the hot cell and then into the basement containment filtration system where eventually it was cleaned enough to be vented out."

"I was primarily up in Building 20 on the hill. As far as I know everything in this building went through air processing contained beneath the building. The building was self-contained, I can't remember but I think there may not have even been any windows in the building. If something needed processing it was processed internally before being discharged to the atmosphere or shipped off-site. There were a lot of below grade processing features at Building 20."

[1] Hot laundry facilities appear to have been located in Building 4283 based on industrial planning maps.

Interviewee 149 worked for Atomics International from 1961 to 1989 occasionally working at SSFL as an engineer and program manager. Interviewee 149 was responsible for some of the oversight at the hot cell along with reviewing some of the written procedures.

> *"The world's largest privately operated hot lab was at SSFL. They did amazing things there – among other things, spent fuel was cut apart and examined. The Fermi-1 fuel that had experienced a meltdown was brought to the SSFL Hot Cell for examination. Fermi-1 was the granddaddy of the sodium-cooled reactor. The Hot Cell facility had 6 cells. A Lionel train was used, on special occasion, to move the fuel from one cell to another."*
>
> *"Technicians did the work in the hot cell. I had oversight of some of these operations and only had a film badge when on site. Someone else would write procedures and I reviewed them. At that time I had responsibility for the engineering release process and design control."*
>
> *"At SSFL there was an experimental plutonium fuel development program for which we were tasked with developing a plutonium fuel. Plutonium in powdered form, I'm guessing 3 percent plutonium with U-238, was formed into cylindrical slugs of different shapes and length that were installed in stainless steel tubes[1]. We studied heat transfer by installing liquid metal (sodium or NaK) as a cladding between the fuel slug and the steel tubing. My group was tasked to write procedures for this process."*
>
> *"Workers wore leaded rubber gloves inside glove boxes when necessary to handle the slugs in their hands because it emitted low level alpha radioactivity. They would always use respirators for breathing protection while doing this work."*
>
> *"I did not work with chemicals and thus had no exposure to them. The technicians used TCE to clean parts. Sodium was sometimes misused – throwing a block of sodium into a pond was unauthorized but it did happen. The burn pit would be the source of these problems. When I was hired in 1961, I was given a tour of the SSFL and the LOX plant was already gone by the time ETEC was up and running."*

From approximately 1960 to 1966, Interviewee 155 worked at SSFL in the Radiation Safety Department (Healthy Physics). The following are excerpts from that interview.

> *"During my employment at Rockwell/AI/North American Aviation, I wore a film badge one hundred percent of the time, as did all personnel working in a radiation area. Every month the film badge was processed. When I was in health physics – radiation safety – if someone was going to work in an area where they could get a higher exposure, then they would wear 2 film badges (a regular one and a visitor badge) as well as a pencil dosimeter. I was the Health Physicist (HP) at the Hot Lab, for a year or so. I would collect the film badges and send them down to headquarters where they would process them or send them to Landauer's in Burbank. They would call me as to what they had found and I would give a report to each person's supervisor. The supervisor would then let anyone know if they had reached their limit for the month and that person would have to be reassigned somewhere else for the remainder of the month."*

[1] The use of plutonium metal in Building 4020 cannot be confirmed in available documents; however, documents do indicate the use of plutonium metal in Building 4055. Additional information is provided below.

> *"As the HP in the Hot Lab, I only did the monitoring (not the film badge processing) and I would take smears daily. If they were going to change manipulators they would lay down plastic or whatever I asked them to do. We had air samplers going constantly. Radiation safety was very important."*

> *"When I started working at the SRE, they were building a new fuel handling machine (FHM). The old FHM still had the broken elements in it the entire time I was there. After I was off rotating shifts, I went in one Saturday with the crew that removed the broken elements from the FHM… The uranium from the fuel elements and the cladding I think went to the Hot Lab."*

Interviewee 166 worked at SSFL in the hot cell for a short time in 1960. The following is an excerpt from that interview.

> *"I worked up at the SSFL periodically in Area 4 during that period doing things like determining densities of fuel elements, simulated testing of fuel elements in one of the reactors, working on a scale in a hot cell, and other related activities. I received a year's worth of radiation in the one day where I worked in the hot cell."*

During the 32 years Interviewee 254 was employed for Atomic International, the interviewee worked a variety of positions at SSFL, including mechanic and Engineer in Charge. Below are several excerpts from the interview.

> *"When I later moved to the Hot Lab, I was monitored monthly because I was working with more radioactive material. There was a monitor at the entrance of the radioactive lab room and you were expected to monitor yourself entering and leaving the lab."*

> *"I moved to Building 20, the Hot Lab, after my time in Building 5. That became my primary place of work. That was a high radiation lab and Building 20 did have a building alarm. You had to sign in and out of the building near the entrance. The health physics office was near the entrance as well and you would go there to get a film badge or dosimeter before leaving the lobby if you didn't already have one on. Building 20 had all kinds of barriers because there were different levels of radiation in the building. If you were in the operating gallery you didn't have to wear any protective clothing, unless you were handling something that could penetrate the walls. If you were on what we called the backside of the building, or the service gallery on this floor plan I have, you had to be fully dressed with coveralls, gloves, and boot covers. If you were "in cell" you had to add another set of coveralls and a respirator. The hot cells had 4-foot thick walls and radiological glass to keep the radiation in the cell. You also had to wear a respirator if the hot cells were being opened or if you were transferring radioactive waste."*

> *"When you came out of the hot cells, the first thing you would do would be to take off one layer of clothing in the decontamination room right outside the hot cell. That top layer would go in a container for disposal as radioactive waste. Then you would step into the hot change room and take off the second layer of clothing. The hot laundry was packaged and sent to the loading dock area and off to the hot laundry facility where the clothes would be cleaned and could then be reused. So when you had two layers of coveralls on*

to work "in cell" you would remove one layer in the decontamination room and then you would remove the second layer in the hot change room. Masks were also laundered and a "cold guy" would help you take off the mask and place it in a bag for laundry."

"Once you were naked, you would go into the shower to rinse off. There was a monitoring device between the hot shower and the cold change area and you would have to check yourself. If anything was picked up on the monitor you had to go back to the hot shower for another rinse to get any remaining radioactivity off of you. You didn't leave the hot shower room until the monitor said you were clean."

"The operators that had to set up equipment in the hot cells wore lots of protective equipment and multiple layers of clothing and gloves because the hot cells were really hot and dirty. You always wore a respirator with supplied air in the hot cells. Depending on what you were working with, you may even wear three layers of coveralls in the hot cell. Sometimes if you were going "in cell" to clean the cell you would even wear raingear."

"The Hot Lab had a hot storage room behind the hot cell. The guy who ran the place, name redacted, was a strange duck… Before he got to the Hot Lab, there wasn't a "dedicated backside man" at the Hot Lab. This was a problem because we found things that were too hot in the backside of the Hot Lab and they shouldn't have been there. He fixed that situation though. I don't think enough money was spent on waste management in the early days. We didn't have dedicated waste handling like we had later… In hindsight, things should have been cleaner and we should have gotten rid of waste faster."

"We had a hot storage and equipment room in the Hot Lab that would store things like a milling machine, drill press, or tools that we needed for operations in the hot cell. The work would change so we would need different tools, but they were all stored in the hot storage. Casks would come in through a door at the north side of the building, through the mock-up and assembly areas. In the case of fuel elements, it was because they were too long to enter the building any other way. The size of the material dictated where it went in the Hot Lab. Metallurgical work was done in Cell 1 because this involved the smallest pieces of fuel. I had to modify and build a machine that would cut out small pieces of fuel and cladding from a fuel element so we could actually work with it. Cell 4 held the largest pieces of hot material, often a section of the fuel rod. As fuel rods were dissected and smaller pieces were removed for examination they were moved into different cells. I remember cutting out small sections of the fuel elements from the SNAP 10 reactor for study in Cell 2. We looked at very small pieces of fuel; it was too hot to work in large quantities. It could make the lens of a microscope go black from high levels of radiation. So we had to invent a system that allowed us to look at very small portions of the fuel. You didn't need a big piece of something to examine it in the metallurgical room."

"I worked at the Hot Lab for many years on and off..."

"Waste from the Hot Lab went into casks, which were essentially lead-lined barrels that were sized based on the quantity of waste and the radiation level. Casks were sent to the

RMDF, now called the RMHF. We held the casks there until we could complete all the paperwork necessary to ship the waste off-site for burial."

"As far as spills go, I only have first-hand knowledge of one spill at the Hot Lab, but I have heard of others. A holdup tank was located in the basement of the Hot Lab (Building 20), under the operating gallery, and it had a line that came out at the north end of the building to a transfer tank. A tanker from the RMDF would pump the radioactive water from the holdup tank and take it to the RMDF where it would be put in an evaporator and reduced to sludge before being disposed. One day either the hose broke or the tank outside the Hot Lab overflowed, I can't remember which exactly, during the transfer process and contaminated water spilled onto the asphalt. The asphalt on the north end of the building became contaminated with the radioactive water. We spent quite a bit of time cleaning that up. We had to invent a super vacuum that used HEPA filters to clean up the contamination. We also used foam to help clean up. We kept cleaning until we brought the radiation down to acceptable levels. That is another safety issue that has changed over time – the acceptable level of contamination. What was acceptable then may not be acceptable now. I'm sure that incident was written up in an incident report."[1]

"I also heard that the asphalt behind the loading dock on the west side of Hot Lab was a spill. I heard later that they dug down about 10 feet to make sure they removed all the contaminated dirt. That was after I had left though."

"Additionally, there was a driveway along the east side of the Hot Lab. At the northeast corner there was a 10-foot high bank. Before the days of chemical containment, chemicals from the shop area of the Hot Lab, such as trichlor, acetone, or paint thinner, were dumped on the ground down this bank."

"The RMDF stored waste, but it also stored items that were waiting examination in the Hot Cell. So some material was stored at RMDF until it could be examined at the Hot Lab, and then when it was done at the Hot Lab it would come back to the RMDF and await final off-site disposal."

"Going back to the Hot Lab, anytime you worked in a hot cell you had to wear two new film badges. You would take off your monthly film badge and put it in your locker and then sign out two new film badges from HP. Then when you got to the backside of the Hot Lab you would put on your two new film badges and a dosimeter before going into the hot cell. The reason for this was that you knew you were going into a very hot area and they wanted to separate out that daily exposure in a hot area from the monthly exposure where you may be working in a variety of different areas. HP would add the hot cell exposures to the monthly exposures so they still kept track of lifetime exposures; they just kept the records separately."

"I was told I received the most radiation of anyone working up there. In those days, we were allowed a lifetime exposure of 100 R and one HP told me I had been exposed to 85 R, the highest of any employee. The company doctor would always monitor us and

[1] This incident was documented in Incident A0016, and is summarized below.

document everything... I did receive an extra large dose one time "in cell" at the Hot Lab and I couldn't go back in there for a while…"

According to an interviewee (255) who worked for Atomics International from 1967 to 1985 as an atomic inspector and certified x-ray technician:

"The only other building I was in on occasion was Building 4020. That was the Hot Lab. I never heard of any spills in there, but when I was in there you had to wear a film badge and a dosimeter. They remotely handled radioactive equipment in the Hot Lab. The operators looked through windows that were essentially two panes of thick glass, separated 30 inches apart, filled with clear oil between the glass panes. I understand that they would pull some fuel rods in there and use remote handlers to put them in a lathe, remove the cladding from the fuel rods, and reclaim the fuel. I wasn't in there for that purpose. I went in there to helium leak test some things they were making up, little radioactive materials they were making up for the space program. I remember running some helium leak tests on little bolts about 1/4 to 1/8 inch in diameter and 1.5 inches long that they had drilled holes in the end of and put a piece of radioactive wire into it before welding it closed. Those bolts went into something destined for outer space."

Interviewee 277 started working at SSFL as a Labor Grade 6 Technician before eventually being promoted to a Labor Grade 17 Technician. Interviewee 277 worked performing a variety of tasks in Area IV of which some time was spent at the Hot Lab. Below are some excerpts from that interview.

"The fuel rods in the canisters were stored at the radioactive materials handling facility (RMHF) until they had cells ready at the Hot Lab (Building 020) to unclad the sodium from the fuel rods. They would open up the bundles at Building 020. We would lower the baskets into the floor vaults at the RMHF. Note that at the Hot Cell Building 020 would always clean up the cells used in each project and then paint the cells in order to keep the Rad contamination down in each cell for the next project."

"We would bid on contracts for receiving fuel rods from other sodium reactors such as Hallam. The cladding and bonding would be removed at Building 20. The fuel rods stored in casks had water in them from the leak test. There were 7, 8, or 9 bundles in each cask. We would take the bundles out of the cask and make sure there was no water on the bundles, there would be water remaining in the cask – not a lot, maybe a couple of gallons. We had to be careful if there was any water in the cask because it would be very hot. We wore film badges and dosimeters. We would wear the dosimeters on our heads and arms. They had been using dosimetry for a good 10 years before I started work there."

"(Regarding disposal of rad waste to floor drains or toilets) Unless somebody had something against the company, it would only have happened by accident or neglect; it was never done intentionally. I do know that Buildings 5 and 24, the Hot Lab, and RMHF had radioactivity in the drains. The system could easily be breached.[1] Also the HEPA

[1] The meaning of this interviewee statement is unknown.

> *vents were radioactive, but they would get blocked and then taken out later when we took the building down."*

> *"… and at the Hot Lab we worked with cleaning fluids but there was no procedure or protocol to dispose of some of the chemicals. The mechanics would put some of it in a coffee can and when they were done, I think the mechanics would just pour it on the ground."*

Interviewee 280 worked for Atomics International from 1959 until 1968 as a Senior Mechanic, primarily at Building 4020, and had the following to say:

> *"At the Hot Lab, we would receive reactors and work on fuels used at the SSFL as well as by other companies, which included examining the fuel, take the elements apart, declad, and test. There were no releases at the Hot Lab. The Hot Lab contained four cells. The front part of the Hot Lab was safe from radiological exposure, and hot items were handled behind walls with mechanical arms. The back room was where exposure was a concern."*

> *"All the rods in the SRE had to be taken apart at the Hot Lab, but most were intact as very few failed or broke apart. I was involved with the cleanup, which included taking things apart to clean and decontaminate."*

Radiological Incident Reports: There have been several incidents associated with Building 4020 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 4020 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0002	8/26/1959	CDHC		Hot Cell Door Ramp Fell Striking An Employees Hand.
A0001	12/5/1959	CDHC	Mixed Fission Product	Radioactive Liquid Spilled During Vendor Pickup.
A0392	4/14/1960	CDHC DECON 4	Mixed Fission Product	Weekly Radiation Limits Exceeded.
A0003	4/18/1960	CDHC	Mixed Fission Product	Irradiated SRE Fuel Slug Placed In An Employees Hand.

Building 4020 Incident Report Summary (continued)

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0011	5/12/1961	CDHC	Mixed Fission Product	Unsafe Handling Of B Of E Cask.
A0505	5/20/1961	CDHC	Mixed Fission Product	Personnel Contaminated During Waste Transfer Operations.
A0347* *This incident is the same as A0505 above.	5/21/1961	SERVICE GALLERY	Mixed Fission Product	Employee Contaminated While Loading Waste Box.
A0283	6/2/1961	CELL 3	Mixed Fission Product	Employee Exposed To Airborne Activity When Supplied Air hose Was Pinched.
A0012	6/19/1961	CDHC C2 & D2	Mixed Fission Product	Employee Attempted To Enter Very High Radiation Area.
A0317	5/9/1962	CELL 4	Mixed Fission Product	Irradiated Fuel Slug Burned In Cell 4 Releasing Radioactive Gas.
A0016	5/31/1962	NORTH PAD/DRAIN	Mixed Fission Product	Portable Radioactive Liquid Tank Overflowed On North Pad Flowing To Surface Drainage.
A0018	9/4/1962	CDHC OP GAL	Mixed Fission Product	Repair Of Fission Gas Analyzer Caused High Airborne Activity And Contaminated Personnel And Lab.
A0020	12/5/1962	ALL	Mixed Fission Product	Contaminated Shoes From Controlled Area Contaminated Most Of Hot Lab.
A0021	1/25/1963	CELL 3	Mixed Fission Product	Employees Hand Contaminated When Glove Tore In Hot Cell.
A0433	5/8/1963	CDHC MOCK-UP	Mixed Fission Product	Waxing Mop Swung Through Controlled Area Contaminated Clean Area.
A0022	7/2/1963	RADIOACTIVE STORAGE YD		Spill Of OMRE HB 40 Coolant In Radioactive Storage Yard.
A0316	7/8/1963	RIHL & OFF SITE	Mixed Fission Product	Employee Contaminated Clothing During Cask Movement Out To Storage Yard.
A0027	9/25/1963	CELL 3	Mixed Fission Product	A Fire Occurred During Dissolution Of NaK From Fuel Decladding In Cell 3.
A0024	9/26/1963	DECON/CELL 3	Mixed Fission Product	NaK And Alcohol Fire During Cleaning Of Fission Gas Monitor.
A0025	9/26/1963	CELL 3	Mixed Fission Product	Exposure Above Guidelines During Cell Clean Up.
A0026	10/9/1963	CELL 2	Mixed Fission Product	Uncontrolled Furnace Left On Overnight Burning Cell Equipment.
A0031	3/20/1964	OP GALLERY	Mixed Fission Product	Fire Suppressing Nitrogen Purge Of Hot Cells Generated Airborne Activity.
A0551	6/8/1964	CDHC SLAVE SHOP	Mixed Fission Product	Unauthorized And Unprotected Employee Contaminated By Contaminated Equipment.
A0443	6/16/1964	CDHC OP GALLERY	Mixed Fission Product	Fuel Element Elevated In Cell Causing Radiation Streaming Thru Slave Ports.
A0338	7/10/1964	SERVICE GALLERY		Outer And Inner Doors To Airlock Open At The Same Time.
A0554	7/23/1964	CDHC CELL 4	Mixed Fission Product	Contaminated Employee Was Deconed By Medical Dept.

Building 4020 Incident Report Summary (continued)

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0354	8/27/1964	OP GALLERY	Mixed Fission Product	High Airborne Activity Resulted After Loss Of Exhaust Controller.
A0415	9/3/1964	CDHC CELL 1	Mixed Fission Product	In-cell Work Resulted In Exposure Above Guidelines And Employee Contamination.
A0337	10/15/1964	SERVICE GALLERY	Mixed Fission Product	Employee Became Contaminated While Bagging Shielding Blanket.
A0574	11/18/1964	CDHC CELL 3	Mixed Fission Product	Exit Survey From Cells Revealed Speck Contamination.
A0033	11/26/1964	NORTH PAD	Mixed Fission Product	Radioactive Liquid Transfer Tank Was Over Filled And Contaminated Outside Area.
A0034	12/7/1964	STORAGE YARD		Radioactive Material Stored In Yard Creating Radiation Levels Above Guidelines.
A0035	5/27/1965	OP GALLERY	Mixed Fission Product	High Airborne Activity During Decladding NaK Bonded Uranium Carbide Fuel.
A0037	7/16/1965	OP GALLERY	Mixed Fission Product	Disintegrated Fuel Deposited In Filter Was Spread During Recovery.
A0441	8/12/1965	AIHL YARD	Mixed Fission Product	Rain Water From One Way Waste Cask Dumped In Clean Area Contaminating Ground.
A0038	9/21/1965	OP GALLERY	Mixed Fission Product	Cell Purging With Nitrogen Caused High Airborne Activity.
A0039	2/2/1966	METALOGRAPH RM	Mixed Fission Product	Extremity Exposure Above Guidelines From Picking Up Irradiated Fuel Sample.
A0040	2/24/1966	SERV GALLERY	Mixed Fission Product	Maintenance Of Contaminated Elox Machine Resulted In High Airborne Activity.
A0042	8/16/1966	ALL OF AIHL		Failure Of Emergency Power Generator Caused Increased Airborne Activity.
A0044	12/31/1966	RM 139	Pm147	Fabrication Of Heat Sources Caused Extremity Exposures Above Guidelines.
A0607	1/28/1967	SER GAL AIHL	Mixed Fission Product	Contamination Tracked From Slave Shop To Service Gallery And Hot Shop.
A0613	4/6/1967	AIHL CELL 3	Mixed Fission Product	Fire Occurred In Cell 3 During Cutting Of Metallurgical Sample.
A0617	5/17/1967	AIHL GLOVE BOX	PM147	Promethium Glove Box Transfer Caused High Airborne Activity And Nasal Smears.
A0619	6/10/1967	AIHL GLOVE BOX	PM147	Waste Removal From The Promethium Glove Boxes Caused High Airborne Activity.
A0046	8/21/1967	RM 139 GLOVE BO	Pm147	Extremity Exposure Above Guidelines During Fabrication Of Heat Sources.
A0047	10/11/1967	RM 139	Pm147	Ingestion Of Pm 147 During Clean Up Operation.
A0627	10/30/1967	AIHL	Mixed Fission Product	AIHL Radioactive Drain System Plugged Up And Flooded Controlled Areas.

Building 4020 Incident Report Summary (continued)

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0050	7/22/1970	CELL 3 AIHL	Mixed Fission Product	Small Alcohol Fire During Disassembly Of NaK Bonded Fuel Element.
A0051	10/11/1970	OP GALLERY AIHL	Ra Th	High Airborne Alarm After Hours Due To Increase In Natural Activity.
A0052	5/19/1971	DECON 4 AIHL	Mixed Fission Product	A Major Fire Resulted During Draining Of NaK Tank In Decon 4.
A0054	7/29/1975	CELL 2 AIHL	Kr 85	SRE Fuel Slug Partially Burned Releasing Radioactive Gas And Contamination.
A0060	9/30/1977	BASEMENT	Mixed Fission Product	Failure To Comply With Requirements Caused Contamination Of Basement Floor.
A0067	4/25/1978	DECON 2	Mixed Fission Product	Employee Contaminated With Concentrate From Sodium Digestion.
A0069	5/3/1978	DECON 2 STILL	Mixed Fission Product	A Five Minute Alcohol Evaporator Fire In Decon 2.
A0076	2/9/1979	DECON 2	Mixed Fission Product	Alcohol Distillation System Spilled Contaminating Employee.
A0088	8/21/1981	HOT STORAGE RM	Mixed Fission Product	Bags Of Radioactive Waste Were Broken During Loading Releasing Contamination.
A0092	10/20/1981	MOCK-UP RM	Mixed Fission Product	Loss Of Control Resulted In Contaminated Ladder In Clean Area.
A0094	12/18/1981	AIR LOCK	Ta182	One Rad Pac Pin Tossed In Radioactive Waste.
A0101	3/22/1982	CELL 1	Mixed Fission Product	Zirconium Fuel Pin Cladding Fines Ignited Causing High Airborne.
A0104	6/28/1982	D 4 AND AIRLOCK	Mixed Fission Product/Ta	Working Two Projects Resulted In Extremity Exposure Above Guidelines.
A0105	7/13/1982	DECON 4	Mixed Fission Product	Faulty Crimping Seal Resulted In Alpha Contamination Of Employees.
A0325	8/16/1982	LIQUID WASTE BL		RAS Alarm Response At RIHL Radioactive Liquid Waste Bldg.
A0110	10/11/1982	DECON 4	Pu/Mixed Fission Product	Leaking Glove box Glove Caused Cross Contamination Of Two Employees.
A0112	12/22/1982	DECON 4		Employee Experienced A Seizure While Working In Controlled Area.
A0262	4/21/1983	MBA 54	Pu	Incorrect Id Of Fuel Rod Resulted In Grams Of Pu In Excess Of Mba Limit.
A0120	7/15/1983	ALPHA BOX D 4	Pu/Mixed Fission Product	Loss Of Glove Seal During Change Out On Alpha Box Contaminated Employee.
A0119	8/8/1983	DECON 3	Mixed Fission Product	Leaking Transfer Tube Contaminated Employee And Decon Room.
A0118	10/11/1983	CELL 3 FACE	Mixed Fission Product	Radioactive Liquid Siphoned From Cell Contaminating Wide Area Of Building.
A0122	1/30/1984	RIHL	Ta182	Contaminated Electrode Was Worked On A Clean Grinder And Tracked Out Of Bldg.

Building 4020 Incident Report Summary (continued)

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0124	3/22/1984	CELL 3	Mixed Fission Product	Protective Clothing Failure Allowed Caustics To Burn And Contaminate Employee
A0125	8/20/1984	CELL 3		During In-Cell Repair An Employee Bumped His Head Drawing Blood.
A0126	8/21/1984	DECON 3	Mixed Fission Product	Employee Contaminated Smearing Low Level Tools With High Level Contamination.
A0127	10/15/1984	CELL 3	Mixed Fission Product	During Remote Decon The Alcohol Caught Fire.
A0128	10/28/1984	SLAVE SHOP	Mixed Fission Product	Employee Contaminated Hands Handling Bag Of Radioactive Waste.
A0129	12/6/1984	CELL 1	Mixed Fission Product	Failure Of Protective Clothing Seal Contaminated Employee.
A0130	12/10/1984	CELL 1	Mixed Fission Product	Failure Of Protective Clothing Seal Contaminated Employee.
A0131	12/10/1984	CELL 1	Mixed Fission Product	Improper Unsuiting Contaminated Employee.
A0133	12/10/1984	CELL 1	Mixed Fission Product	During Decon Of Cell 1 Extremity Exposure Exceeded Administrative Guidelines.
A0134	1/14/1985	DECON 1	Mixed Fission Product	Bag Radioactive Waste Came Untaped And Contaminated Employees Pants.
A0132	1/15/1985	SLAVE SHOP	Mixed Fission Product	Employee Cut Finger With Contaminated Screwdriver.
A0135	2/20/1985	SHOP	Mixed Fission Product	Employee Cut Finger On Cell 4 End Door Gear Shaft During Repair.
A0136	3/4/1985	CELL 1	Mixed Fission Product	Contaminated Sharp Object Punctured Protective Clothing Contaminating Shoes.
A0137	3/20/1985	SERVICE GALLERY	Mixed Fission Product	Contaminated Item From Cell 1 Contaminated Personnel And Area When Opened.
A0139	6/6/1985	SLAVE SHOP	Mixed Fission Product	Decon With Acid Resulted In Burning And Contamination Of Employee.
A0140	8/12/1985	DECON 1	Mixed Fission Product	Contaminated Puncture Wound Occurred During Packaging Radioactive Glass Waste.
A0142	10/4/1985	SERVICE GALLERY	Mixed Fission Product	Personal Clothing Worn Under Protective Clothing Became Contaminated.
A0141	10/17/1985	CELL 3	Mixed Fission Product	Sharp Object In Cell 3 Punctured Protective Clothing Contaminating Shoes.
A0147	10/25/1985	CELL 3	Mixed Fission Product	Protective Clothing Leached Contamination Onto Employee.
A0148	11/4/1985	CELL 3	Mixed Fission Product	Protective Clothing Leached Contamination Onto Employee.
A0145	11/13/1985	CELL 3	Mixed Fission Product	Protective Clothing Leached Contamination Onto Personal Shoes And Socks.
A0143	11/20/1985	CELL 4	Mixed Fission Product	Protective Clothing Leached Contamination Onto Personal Shoes And Socks.

Building 4020 Incident Report Summary (continued)

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0144	11/21/1985	CELL 3	Mixed Fission Product	Protective Clothing Leached Contamination Onto Personal Shoes And Socks.
A0146	11/22/1985	DECON 4	Mixed Fission Product	Protective Clothing Leached Contamination Onto Personal Shoes And Socks.
A0149	12/10/1985	HOT STORAGE RM	Mixed Fission Product	Employee Pinched Hand While Loading Radioactive Waste In Box Drawing Blood.
A0150	1/14/1986	ALL RIHL		A Review Of Recent Nonreportable Incidents At RIHL.
A0151	2/4/1986	CELL 4		Loss Of Breathing Air Supply During Cell Entry.
A0152	2/19/1986	RM 139		Maintenance Employee Cut Finger On Radioactive Exhaust Plenum.
A0155	3/4/1986	SERVICE GALLERY		Alconox And Water Solution Splashed In Eye Of Employee.
A0156	4/16/1986	HOT STORAGE RM	Sr90	Inventory Revealed Check Source Missing.
A0165	10/28/1986	CELL 4	U/Mixed Fission Product	Ignition Of Fermi Saw Chips During Disassembly In Cell 4.
A0173	3/12/1987	CELL 4		Employee Passed Out From Heat Exhaustion In Radioactive Environment Of Cell 4.
A0174	7/10/1987	CELL 2	Mixed Fission Product	Employee Contaminated Wrist During Doffing Protective Clothing.
A0175	7/14/1987	CELL 2	Mixed Fission Product	Protective Clothing Seal Failure Resulted In Contamination Of Employee's Neck.
A0177	7/20/1987	CELL 2	Mixed Fission Product	Exit Survey Revealed Neck Contamination On Employee.
A0178	10/15/1987	SERVICE GALLERY	Mixed Fission Product	Waste Handling Exit Survey Revealed Contaminated Pants.
A0181	12/1/1987	OPERATING GAL		Employee Pinched Finger And Drew Blood While Working With Radioactive Shield Plug.
A0182	12/17/1987	SUMP PUMP		Employees Entered RAAEP Area And Confined Space Without Permits Or Approvals[a]
A0185	6/13/1988	BASEMENT ALCOVE		Faulty Meter Alarmed Security Guards.
A0190	9/30/1988	CELL 1	Mixed Fission Product	Exit Survey Revealed Contamination On Knee After Cell Work.
A0191	10/10/1988	CELL 1	Mixed Fission Product	Exit Survey Revealed Contamination On Knee And Forearms After Cell Work.
A0192	11/14/1988	STORAGE RM 153		Employee Received Puncture Wound In Contaminated Area.
A0193	1/4/1989	CELL 1	Mixed Fission Product	Improper Seal Of Protective Equipment Allowed Radioactive Inhalation By Employee.
A0198	6/6/1989	CELL 1	Mixed Fission Product	Employee Exit Survey Revealed Contamination From In-Cell Operation.

Building 4020 Incident Report Summary (continued)

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0199	6/29/1989	CELL 2 & DECN 1	Mixed Fission Product	Exit Survey Revealed General Point Of Contact Contamination.
A0201	10/4/1989	GLOVE BOX RM139	Pu	Puncture Wound In Plutonium Glove Box Room.
A0587	12/15/1989	RIHL AIRLOCK		Filter Failure On Vacuum Cleaner During Scabbling Of Contaminated Concrete.
A0205	4/18/1990	CELL 2	Mixed Fission Product	Contaminated Steel Chip Projectile Penetrated Wrist Cutting Radial Artery.
A0207	7/17/1990	CELL 3	Mixed Fission Product	Ladder Slid Out From Under Employee While Sledge Hammering In Cell.
A0210	10/17/1990	SERVICE GALLERY	Mixed Fission Product	A Dropped Duct Section Missed Employees But Caused Airborne Activity.
A0213	12/17/1990	T468 RADIOACTIVE LIQ BL		False Reading On RAS Detector Caused Alarm.
A0267	8/26/1991	OPERATING GAL		Contamination Barriers Blown Out Into Clean Area By Grit Blaster In Cell.
A0571	6/17/1993	RIHL BASEMENT	Mixed Fission Product	Employee Became Contaminated During D&D Of Radioactive Exhaust Duct.
A0575	9/15/1993	RIHL CELL 3		Dosimeter Went Off Scale During Work In High Radiation Area.
A0662	5/10/1995	AREA IV, DECON3		Dumping Of Vacuum Catch Drum Without Notification.
A0668	4/16/1996	SS T020 Rm 147		Particle On Right Shoe
A0675	3/26/1997	PARKING LOT		Loss Of Control Of Radioactive Material
A0677	7/2/1997	FRISKED SHOE		Contaminated Pipe
A0679	8/15/1997	RUBBER BOOT		Rubber Boot Had A Hole In It
A0678	8/15/1997	LEFT HAND		Contractor Removed Paper Suit Without Gloves
A0689	10/1/1997	T020 PARKIN LOT		Shipment Of Clean T020 Building Debris Prior To State Confirmatory Survey
A0682	3/20/1998	South Stor. Yd		Unauthorized Move Of Radioactive Material

[a] The acronym RAAEP cannot be defined from available documents. On December 17, 1987, an incident occurred at a sump pump and employees entered a confined space without the proper permits or approval (Incident Report A0182). The original incident report is identified as missing from Boeing's incident files. No other details are available on this incident at this time.

Incidents of known environmental releases:

- On December 5, 1959, radioactive liquid spilled during vendor pick up and contaminated the vendor's truck. The Coastwise Marine Disposal Company arrived to pick up approximately 2,000 gallons of liquid waste from the hold-up tanks in the basement of Building 4020. The truck was parked adjacent to the north loading dock of the building and the flow of liquid was controlled by a valve near the dock. The van was loaded with 51 empty 55-gallon drums and lids. The wooden floor of the van was covered with a white powder used to solidify liquid waste, but the floor was not watertight. A long plank was resting on top of the drums for walking from the back to the front of the van and a long stick was used for stirring the solidifying agent into the wastewater. The first drum of water was pumped out to the 50-gallon mark and then the solidifying agent was added to demonstrate its capabilities.

When the agent was dumped into the drum, a small amount of radioactive water splattered out into the truck body and flooring and also onto some planks in the back of the open van. The vendor was directed to put some covering down in the back of the open van. A piece of plastic sheeting was provided and the vendors were told not to move off the plastic without removing all protective clothing and leaving it on the plastic sheeting. A bit later, a small amount of water was observed coming out of the van body and running onto the rear wheels of the van. Solidifying agent was immediately thrown on the floor of the van to try and soak up the radioactive water that was trickling down onto the wheels and ground. Pumping of the water was halted until a satisfactory means of controlling the water inside the van body was devised so that more radioactive water would not be spilled onto the asphalt loading pad. The wastewater transfer was stopped until the degree of contamination could be determined.

Smears were taken of the truck wheels, axle, and body and the asphalt area under the truck. Twenty smears were taken and averaged approximately 75 disintegrations per minute per 100 centimeters squared (dpm/100 cm^2) beta-gamma. The background radiation intensity had not risen on the survey instrument over normal levels. Pumping operations were discontinued until the truck and area were decontaminated to a level of 30 dpm/100 cm^2 beta-gamma, the Atomics International contamination limit for an uncontrolled area. The truck was wiped down and allowed to leave the area after smears showed the beta-gamma measurement was less than 30 dpm/100 cm^2 (Incident Report A0001).[1]

The quantity of liquid waste that was released to the ground surface was not reported in this incident report. Additionally, the report does not describe any cleanup efforts that were made on the asphalt surface. Resulting contamination on the asphalt surface would have flowed to the northeast across the parking lot into the drainage ditch on the south side of G Street.

- On May 9, 1962, a fire occurred in Cell #4 of Building 4020. Prior to the fire, an irradiated capsule containing uranium slugs in a stainless steel tube bonded with sodium-potassium alloy (NaK) was being disassembled in the Hot Lab. The capsule was separated into two pieces and during decladding of the longer piece in Cell #4 the liquid nitrogen supply necessary to maintain the cell atmosphere ran out. Examination of the fuel was discontinued and the fuel slugs were stored under amyl alcohol in a metal tray and covered with a metal plate.

  It was thought that a piece of partially oxidized NaK may have fallen onto the cell floor during the transfer of slugs to the metal tray. When the humidity in the cell increased, the NaK oxidized at a rate that generated sufficient heat to ignite the cell floor covering and the alcohol vapors outside the metal tray. Alcohol inside the tray also evaporated exposing the fuel slugs to air and allowing NaK inside the slugs to oxidize. Three of the

[1] Clow, H.E., Atomics International Internal Letter, *Re: Liquid Waste Removal at CDHC,* January 20, 1960.

nine fuel slugs were destroyed completely. According to the incident report, at the time of the fire, the only volatile radioisotopes remaining in the fuel in significant quantities were krypton-85 (Kr-85) and iodine-131 (I-131). A maximum of 7.8 x 10^{-5} micro curies per cubic centimeter (µCi/cc) of Kr-85 and 1.3 x 10^{-6} µCi/cc of I-131 were estimated to be released through the exhaust stack. The incident report summarized that the release could not have resulted in significant exposure to personnel or surrounding areas (Incident Report A0317).[1]

- On May 31, 1962, a portable radioactive liquid holdup tank was being filled from the radioactive holdup tank inside Building 4020. The operator's attention was diverted by a leaking pipe fitting at the bottom of the portable tank. While the operator was tightening the pipe fitting, the portable tank overflowed and a maximum of 50 gallons of liquid was spilled. Analysis of the liquid remaining in the tank showed an activity level of 2.2 x 10^{-3} µCi/cc, indicating a total activity of 420 µCi involved in the spill. The portable tank was on a concrete pad surrounded by an asphalt apron that sloped to the roadway. The spilled liquid immediately flowed down slope to the road and then to a drainage ditch, which connected to the "cold sewerage system." The pattern of the spill is shown in a Building 4020 figure included in this report (Figure 2.2.1s).

  Decontamination procedures began immediately. Within minutes of the spill the area was hosed down with fire hoses to prevent any fixation of particulate matter and to dilute liquid already in the drainage ditch. The area was roped off and decontamination of the asphalt began with mops and brushes. Prior to decontamination smears of the asphalt and concrete pad were as high as 50,000 dpm. After a series of scrubbing procedures the area was decontaminated to the point that no detectable removable contamination was found. The area was then surveyed with a portable floor monitor and a 2612 G.M. survey instrument to locate areas of fixed contamination.

  Thirty-seven "hot-spots" approximately 2 inches in diameter were found to have radiation levels in excess of 1 millirad per hour (mrad/hr). Levels ranged from 2 mrad/hr to 130 mrad/hr beta-gamma. These areas were marked with white paint and chipped away. Following chipping, no detectable activity remained. A survey of the drainage ditch with the 2612 G.M. survey instrument found no activity above normal background. Sixty samples were taken from the bed of the drainage ditch from the site of the spill to the sewage treatment facility. Contamination levels ranged from less than 30 dpm to greater than 500 dpm beta-gamma, with an average of approximately 100 dpm beta-gamma contamination. The ditch was sampled from the site of the incident to its entry into the sewage treatment facility. The contamination appeared to be evenly distributed throughout this 400 yard length. Surface soil samples of the ditch showed contamination in the amount of 0.06 micro curies per square foot (µCi/ft^2) (using a factor of 10 for self absorption of the sample). The entire length of the ditch was approximately 1,500 square feet (ft^2), so it was estimated that the total contamination remaining in the ditch was 90 µCi. The incident report notes that removal of the contamination was probably not warranted by the contamination levels, the "narrow, tortuous and deep" nature of the ditch, and the fact that the ditch traversed unoccupied areas. Additional flushing was seen as increasing the rate of contamination in the sewer system. It appears from the

[1] Remley, M.E., Atomics International, to Levy, J. V., U.S. Atomic Energy Commission, *Re: Fire in the Component Development Hot Cell, May 9*, June 7, 1962.

incident report that no other cleanup was performed, although recommendations for prevention of similar incidents were made (Incident Report A0016).[1,2]

- On July 2, 1963, an area in the radioactive holding area of Building 4020 approximately 15 feet by 3 feet was contaminated to a level of 7.4 x 10^4 µCi/cc. The incident report did not provide a detailed description of the location of this contamination. The Health and Safety Section requested the area be decontaminated and sealed before the contamination spread to other clean areas. This area was contaminated during a spill of "EB 40" from the Organic Moderated Reactor Experiment (OMRE) cask (Incident Report A0022).[3]

- On July 8, 1963, three Atomics International employees working at Building 4020 were contaminated while moving a cask containing radioactive waste material. The cask was transferred from Cell #1 to a building airlock using a fork lift and special lifting rig. At the airlock the cask was placed in clean plastic bags. The cask was then transferred to a clean fork lift outside the building, without changing the contaminated lifting rig that had been used inside the building. Three employees working outside the building had contact with the contaminated lifting rig. Because the three employees were involved in different stages of the procedure and had continued on to other activities in the day, personnel contamination was discovered over the course of a day. One employee had to have his car and home surveyed as he had gone home before the contaminated lifting rig had been discovered. A spot of contamination was noted on the employee's shirt and his trousers at 0.03 mr/hr and 0.7 mr/hr, respectively; however, it was not felt that contamination had spread outside of Atomics International premises (units may be incorrectly presented in the source document). The lifting rig was decontaminated and personnel surveys indicated no significant external or internal radiation exposure (Incident Report A0316).[4]

- On September 25, 1963, a fire occurred in Cell #3 of Building 4020. The fire occurred during the dissolving of NaK bonding material on fuel cladding using butyl alcohol, a routine operation. Concurrent with the start of the fire, the operating gallery continuous air monitor increased approximately 400 Ci/m beta-gamma.[5] A high volume air sample taken in front of Cell #3 after the fire began indicated 9.4 x 10^{-10} µCi/cc beta-gamma, a factor of 10 higher than a sample taken a short time before the fire. The fire burned a piece of wood, Tygon tubing, butyl alcohol, blotter paper, and the plastic boot that helps keep the contamination levels of the manipulator down. The fire was extinguished within 10 minutes using a nitrogen purge. The airborne concentrations were significant and bioassays of all personnel in the area at the time of the fire indicated a positive and significant intake of mixed fission product. If the cell had not recently undergone a major cleanup, the airborne release could have been more serious. During investigation of the

[1] Heine, W.F., Atomics International Internal Letter, *Re: Radioactive Spill at CDHC Bldg. 20 Santa Susana*, June 13, 1962.
[2] Coonce, G.L., Atomics International Internal Letter, *Re: Contamination Survey*, June 7, 1962.
[3] Lane, W.D., North American Aviation, Inc. Internal Letter, *Re: Decontamination of R/A Holding Area at CDHC*, July 2, 1963.
[4] Remley, M.E., Atomics International, to Levy, J.V., U.S. Atomic Energy Commission, *Re: Unusual Incident at the Component Development Hot Cell*, July 15, 1963.
[5] It is unclear from the incident report whether the operating gallery continuous air monitor increased approximately 400 Ci/m beta-gamma or 400 cpm beta-gamma.

incident it was discovered that air flow in the building was below design standards in some areas (Incident Report A0027).[1]

- On November 24, 1964 a radioactive spill resulting from the overflow of a 500-gallon portable liquid holdup tank occurred in the north loading dock area of Building 4020. Transfer of the liquid waste from inside of Building 4020 had stopped when the pump malfunctioned leaving the transfer tank half full. Repairs were made and pumping was restarted at a rate of 30 gallons per minute. The operator, unaware the pump was working at full rate, was approximately 12 feet from the tank when it overflowed. The shutoff valve was immediately closed and a maximum of 25 gallons of liquid was lost at the north loading dock area.

  Analysis of the liquid remaining in the transfer line showed an activity of 2.4×10^{-1} µCi/cc indicating a total release of 2.3×10^{4} µCi/cc was involved in the spill. The radioactive liquid included Cs-137, zirconium-95 (Zr-95), and niobium-95 (Nb-95). Approximately 300 ft^2 of cement pad and asphalt were contaminated. The spill area was outlined with spray paint and desiccant was placed in the larger puddles to control runoff. A radiation survey indicated general levels of 10-15 mrad/hr beta-gamma activity and a maximum of 20 mrad/hr beta-gamma at approximately 2 inches above the water on the ground.

  Preliminary decontamination efforts included scrubbing and vacuum cleaning. The gross contamination of the cement pad was reduced to 1 mrad/hr at the surface and less than 10,000 dpm beta-gamma on a tape smear. Levels on the asphalt, which was covered with a primer coat of paint, were 20 mrad/hr beta-gamma. Final decontamination efforts were completed on December 2, 1964. A final survey showed the cement pad to have 0.3 – 0.5 mrad/hr beta-gamma at the surface, less than 150 dpm beta-gamma on a tape smear, and less than 30 dpm/cm^2 beta-gamma on a normal smear, with three small surface cracks indicating 1.0 mrad/hr. A second coating of primer was applied to the asphalt and a maximum radiation level of 20 mrad/hr beta-gamma was embedded in the asphalt. No removable contamination was evident after the second coat of primer. The contaminated asphalt was not removed. Health and Safety determined that no further decontamination be performed, but the area would be routinely surveyed for future smearable contamination (A0033).[2]

- On May 27, 1965, Cell #3 was under a nitrogen purge to accommodate the decladding of irradiated uranium carbide fuel. The cladding was cut and NaK oozed out. An air monitor at the north end of the operating gallery started to increase setting off the primary alarm (1,000 Ci/m) and then the upper alarm point of 3,000 Ci/m. The 12 minute air sample indicated 1.5×10^{-8} µCi/cc. A second air sample taken 30 minutes after the initial alarm was 2.3×10^{-9} µCi/cc. Smears taken throughout the area were less than 30 dpm. A third air sample taken fifty minutes after the initial alarm indicated 7.3×10^{-10} µCi/cc beta-gamma immediate count This sample was recounted 90 minutes later and was 1.4×10^{-10} µCi/cc beta-gamma. The stack monitor indicated two distinct increases in activity.

[1] Badger, F.H., North American Aviation Internal Letter, *Re: Investigation of In-Cell Fire at CDHC*, November 4, 1963.
[2] Ericson, G.I., Atomics International Internal Letter, *Re: Radioactive Liquid Spill at CDHC Building 020*, January 12, 1965.

The maximum count rate was 500 Ci/m or an estimated 6.5 x 10^{-8} µCi/cc. The total gaseous release at the stack was estimated to be 0.12 mCi over a two hour period. No personnel or equipment contamination was detected (Incident Report A0035).[1]

- On August 12, 1965, rainwater from a one-way waste cask was being dumped in a "non-radioactive outside storage area" at the Hot Lab when an "unusually large" volume of water spilled out of the cask. The incident report did not provide a detailed description of the location of the incident. A survey of the water found it contaminated with 300 µCi of mixed fission product in suspension. The runoff was contained and the area secured. An absorbent was placed on the liquid and contamination was measured up to 20 mrad/hr. After vacuuming the absorbent and scrubbing the area with "Radiac Wash" the contamination was brought down to 0.2 mrad/hr. Contamination was confined to a 3-foot by 10-foot section of asphalt and no personnel contamination resulted from the incident. It was surmised that the cask had been improperly tagged and had possible internal contamination (Incident Report A0441).[2]

- On October 30, 1967, a radioactive liquid drain system clogged, spreading contaminated water throughout controlled areas of Building 4020. The water was pumped into the Radioactive Materials Handling Facility (RMHF) 500-gallon transfer tank, but removable beta contamination levels as high as 1.3 x 10^6 dpm/100 cm^2 remained. It was reported that all areas were successfully decontaminated (Incident Report A0627); however, details of the decontamination efforts were not provided.[3]

- On May 19, 1971, there was a fire in Decon #4 during the disposal of 100 gallons of liquid NaK, which contained 100 µCi of mixed fission products. A hole in a tank fill line caused the release of about 25 gallons of contaminated NaK, which then caught fire. Nearly all contamination was contained in Building 4020. Airborne activity and surface radiological contamination concentrations inside the building from the event range from 2 percent to 20 percent of permissible concentration for occupational use and the average concentration released through the stack to the outside of the facility was about 5 percent of the permitted concentration for an unrestricted area (Incident Report A0052).

- On July 29, 1975, a single irradiated SRE fuel slug ignited and partially burned in Cell #2 releasing an estimated 0.77 mCi of Kr-85 gas out of the stack and resulting in the momentary release of airborne radioactivity to the operating gallery. The fire was extinguished in 20 minutes with a nitrogen purge. The incident did not result in any overexposure and did not constitute a reportable incident. The SRE Core I fuel was being prepared for reprocessing by removing all NaK from the fuel slugs.

  The planned NaK distillation proved ineffective on badly damaged fuel and a new system was developed in Cell #2 to heat the fuel slugs and sweat the NaK out then dissolve it in alcohol. The slug in question had been soaked in alcohol for several days and ignited when it was heated with a high intensity lamp. The continuous air monitor in the

[1] Badger, F.H., Atomics International Internal Letter, *Re: Incident Report*, June 25, 1965.
[2] Badger, F.H., Atomics International Internal Letter, *Re: Incident Report, Non-Radioactive Outside Storage Area at AIHL Bldg. 020, SS, 8-12-65*, August 16, 1965.
[3] Alexander, R.E., Atomics International Internal Letter, *Re: Radiation Safety Unit Weekly Newsletter for Period Ending November 4, 1967*, November 10, 1967.

operating gallery stabilized at 6,000 cpm. The stack monitor indicated 700 cpm or 6.5 x 10^{-6} µCi/cc going out the stack. Routine analysis of basement air samples indicated 1.87 x 10^{-8} µCi/cc beta-gamma for a seven day period following the fire. This was a result of airborne activity released to the operating gallery being drawn down the electrical breezeway into up-air dampers in the basement (Incident Report A0054).[1]

- On October 20, 1981, a "clean" ladder located in an uncontrolled area and scheduled to be loaned out was routinely surveyed and found to be contaminated. The feet of the ladder indicated the highest activity with 30 mrad/hr beta-gamma and 5,000 dpm/ 100 cm^2 beta-gamma removable contamination. A general contamination level of 1,000 to 2,000 dpm/100 cm^2. No signification alpha activity was detected. The ladder was bagged and placed in a controlled area. All personnel were surveyed and the facility was smeared. No other activity was detected, with the exception of 300 dpm/ 100 cm^2 beta-gamma in Room 139 alongside a file cabinet. Further investigation found the ladder was from the radiologically-controlled service galley area of Building 4020. It had been used in painting Decon #4 in May 1980 and then accounting of the ladder after that time became vague (Incident Report A0092).[2]

- On December 18, 1981, a survey of the "Rad Pac" loading area of the airlock indicated an abnormally high reading from a low level waste can. A controlled search of the waste revealed a "Rad Pac" pin entangled in a Kimwipe. The tantalum-182 source pin measured 16.5 mCi of radioactivity. Typically, sources are calibrated individually and stored in numbered holes in a lead brick. Then the specific source pins for the customer are grouped for sealing in capsules and remove to a storage pig. The remaining source pins are removed and placed in a storage vial on a Kimwipe. The vial is closed and placed outside the storage pig. A mechanic missed placing one pin in the vial and it became hidden in a fold of the Kimwipe (Incident Report A0094).[3]

- On March 22, 1982, zirconium fuel pin fines (fine particles) from grinding of Fermi fuel in Cell #1 reacted violently during an oxidation process and nitrogen purge resulting in high airborne activity in an uncontrolled area of Building 4020. Fermi fuel pins are clad with zirconium. In order to recover the 25 percent enriched uranium remaining in the fuel the zirconium must be removed. Center-less grinding of the fuel was the preferred method. The grindings would be filtered from the coolant and oxidized in a furnace to render the normally unpredictable flammability of the zirconium fines harmless. The wet filter papers with wet fines were stored in a sealed tube until loaded into the furnace. The cell atmosphere would be reduced to less than 5 percent oxygen by a nitrogen purge. The furnace and fines were put under a vacuum to remove water vapor and then the furnace was turned on to 1,650 degrees Fahrenheit until the fines were oxidized. The oxide would then be placed in a storage can for analysis and disposition.

[1] Badger, F.H., Rockwell International Internal Letter, *Re: Fuel Slug Fire – Cell 2, July 29, 1975*, September 29, 1975.
[2] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020, October 20, 1981*, November 19, 1981.
[3] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Airlock, 12/18/81*, December 23, 1981.

During the incident, an "O" ring failed and created a loss of vacuum, allowing the "O" ring to burn. The electrical power to the operation was shut down and personnel were evacuated. Initial air samples and smears were normal and personnel returned to work. The oxygen content in Cell #1 was below 5 percent so the high volume nitrogen purge was switched to low volume and the furnace cool down air jets were started. A bit later, an air monitor in the operating gallery was checked again and showed a sharp increase in beta-gamma activity (~1,500 cpm). Additionally, the stack monitor showed a 400 cpm increase in particulate activity and a basement air monitor alarmed at ~3,500 cpm. A dilution fan was started and a high volume air sample was taken showing 3 x 10^{-9} µCi/cc. The nitrogen purge rate was changed and the air monitor in the operating gallery stabilized.

Air samples were collected through the building and analyzed. Activities were calculated on the basis of a one hour release. The maximum release occurred in the basement, an unoccupied area, at 1.3 x 10^{-8} µCi/cc. The maximum release in an occupied area was 3.4 x 10^{-9} µCi/cc at the face of Cell #2. The activity in the stack sample with a one hour base was 1.2 x 10^{-10} µCi/cc. Analysis of the air samples indicated Cs-137 as the dominant isotope and possible antimony-125 (Sb-125). No other isotopes were identified. Investigation found controllers on the cell purge systems were not working properly and cracks were noted in the radioactive exhaust ducts in the basement. The release of airborne activity was found to be the result of faulty controllers and activation of the furnace air jet cooling system while on a low volume nitrogen purge. All operations were halted until corrective actions and another safety review of the operations could be conducted (Incident Report A0101).[1,2]

- On March 26, 1997, a block with low level contamination was inadvertently not surveyed and released as clean. It was transferred to a radiologically uncontrolled area at the Hot Lab. The contaminated block (300 cpm) was discovered during a state confirmation survey. The block was moved into a radioactive material area and the contamination was reduced to less than 20 dpm/cm^2 alpha, less than 100 dpm/cm^2 beta, less than 100 cpm above lowest background, and less than 5 µr/hr (units may be incorrectly presented in the source document) above ambient background (Incident Report A0675).[3]

- On July 2, 1997, a block originally connected to a highly contaminated drain pipe and believed to be filled with concrete slurry was removed, leaking contamination onto the soil and asphalt. The discovery was made after an employee working in the area found contamination on his shoe (800 cpm). The affected area was roped off and highlighted for decontamination. The cause of the incident was determined to be incorrect handling procedures for the block, which was not originally known to be connected to the

[1] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 – Cell 1, March 22, 1982*, March 29, 1982.
[2] Badger, F.H., Rockwell International Internal Letter, *Re: Final Report – Fermi Zirconium Fines Explosion Bldg. 20*, April 2, 1982.
[3] Harcombe, R., Boeing Internal Letter, *Re: Incident Report, Loss of Control of Radioactive Material, A0675, T020 Parking Lot, 3/26/97*, April 9, 1997.

contaminated drain pipe (Incident Report A0677). Additional information regarding the decontamination of this area could not be located in available documents.[1]

- On October 15, 1997, it was discovered that a roll-off of scrap material from Building 4020 was released to an outside contractor without a California Department of Health Services confirmatory survey. The materials in the roll-off had been surveyed clean, the survey documented, and the roll-off released from radiological control by Rocketdyne Health Physics. The state was not given the opportunity to perform a confirmatory survey as required under Rocketdyne's license. A notice of violation was issued. Rocketdyne implemented corrective procedural actions to prevent a recurrence (Incident Report A0689).[2]

- On March 17, 1998, four unauthorized contract personnel were loading concrete blocks on a flatbed truck from the radioactive materials area at Building 4020. The personnel were not "radiological worker qualified" and thus not authorized for area access. The "Radioactive Materials Area" posting boundary rope had been removed without authorization. A verbal stop work was issued and personnel were released from the area after being surveyed for radioactive contamination. All contract labor received additional training, and it was determined that the contract workers were allowed through control gates prior to the site supervisor being notified of their arrival (Incident Report A0682).[3]

Current Use: The building was completely demolished between 1995 and 1996, and the site was backfilled in 1997.[4] On January 31, 2005, DOE provided a letter to Boeing declaring that Boeing and ORISE surveys confirmed that DOE and DHS-approved soil cleanup levels had been met and that the Building 4020 site was suitable for release for unrestricted use.[5]

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

- **1973-1997 Annual Environmental Monitoring.** According to the 1973 annual report for environmental and radioactive effluent monitoring, the gaseous effluent released to unrestricted areas was monitored at Building 4020. Monitoring included the volume of the effluent releases, the average and maximum concentration (μCi/mL), and the total activity released (Ci). The results of this yearly data are presented in the annual environmental monitoring and facility effluent reports from 1973 through 1997.[6,7,8,1,2,3,4,5,6,7,8]

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[1] Deschamps, R., Boeing Internal Letter, *Re: Incident Report, Contamination Found on Employee's Shoe, A0677, T020, 7/2/97*, April 15, 1998.
[2] Guy, E., Energy Technology Engineering Center, *Occurrence Report, SAN—ETEC-GENL-1997-0001*, January 29, 1998.
[3] Schaeppi, W., Boeing Internal Letter, *Re: Unauthorized Movement of Radioactive Material*, March 23, 1998.
[4] Boeing, Document No. EID-06141, *Hot Laboratory Decontamination and Dismantlement Final Report*, November 27, 2001.
[5] Lopez, M., Letter Re: Release of Building 4020, January 31, 2005.
[6] Moore, J.D., *Environmental and Radioactive Effluent Monitoring Annual Report 1973*, Undated.
[7] Rockwell International, Report No. ESG-79-7, *Environmental Monitoring and Facility Effluent Annual Report 1978*, April 1979.
[8] Rockwell International, Report No. ESG-81-17, *Environmental Monitoring and Facility Effluent Annual Report 1980*, May 27, 1981.

- **1996-1997 Building 4020 Decontamination and Decommissioning (D&D).** During the 1996 and 1997 excavation of the Building 4020 area and the surrounding asphalt and concrete, Rocketdyne took 135 soil samples to verify that any soil left in place and used as backfill met the release limits at the time. According to the 2000 final MARSSIM status survey report, which included a summary of the results as Appendix E of the report, the only man-made isotope detected was Cs-137 with the highest detectable level in soil being 0.91 pCi/g with an average level of 0.17 pCi/g. The location of the sample with the highest detectable level in soil was a surface soil sample located under the concrete slab at the southwest end of the service gallery. The report indicated that all samples were below the clean-up standard of 9.2 pCi/g. Soil samples were taken at the surface and to a depth of up to 18 feet below ground surface. As indicated above, when the excavation was backfilled, a 1-foot layer of sand was placed to indicate the depth of excavation.[9]

- **1998 Boeing Soil Sample Survey.** Boeing performed a soil sample survey in 1998 to ensure the Building 4020 site and leach pits were free of radiological contamination. The survey found no radioactivity above background levels. Measurements of activity ranges from 1,897 to 2,194 cpm compared with an average background measurement of 2,013 ± 50 cpm. Most soil samples were less than the minimum detectable activity of 0.02 pCi/g for Cs-137, with the highest measurement being 0.21 pCi/g (Cs-137 $DCGL_w$ is 9.2 pCi/g).[10]

- **1998-1999 State of California Radiological Health Branch Confirmatory Surveys.** During the course of demolition efforts, the State of California Radiological Health Branch performed confirmatory surveys of Building 4020 concrete blocks and building debris. These surveys were performed in 1998 and 1999 because at the time of demolition, the blocks were found to have radioactive contamination of several surfaces and were decontaminated by Boeing. The survey was to determine whether the blocks could be released for unrestricted use as defined in the Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use, DECON-1. For the purposes of these surveys, background measurements were taken at Building 4487. The surveys determined the representative sample of the concrete blocks were all at

[1] Rockwell International, Report No. ESG-82-21, *Environmental Monitoring and Facility Effluent Annual Report 1981*, July 15, 1982.
[2] Rockwell International, Report No. ESG-83-17, *Environmental Monitoring and Facility Effluent Annual Report 1982*, June 1983.
[3] Rockwell International, Report No. ESG-84-9, *Environmental Monitoring and Facility Effluent Annual Report 1983*, March 1984.
[4] Rockwell International, Report No. RI/RD85-123, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1984*, March 1985.
[5] Rockwell International, Report No. ESG-84-9, *Environmental Monitoring and Facility Effluent Annual Report 1983*, March 1984.
[6] Rockwell International, Report No. RI/RD85-123, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1984*, March 1985.
[7] Rockwell International, Report No. RI/RD86-140, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1985*,April 1986.
[8] Rockwell International, Report No. RI/RD87-133, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1986*, March 1987.
[9] Boeing, Document No. RS-00010, *Area 4020, MARSSIM Final Status Survey Report*, October 31, 2000.
[10] Shao, J., Letter Re: Soil Sampling Results for Buildings 468 & 020 at SSFL, August 3, 1998.

background levels, and the results of the contact measurements and laboratory analysis of collected samples indicated activity levels below the acceptable surface contamination levels in DECON-1. Accordingly, the State of California recommended the approval for release for unrestricted use of the concrete.[1,2,3]

- **1999 Rocketdyne Final Status Survey.** Rocketdyne performed a MARSSIM final status survey in September 1999, of the Hot Lab facility and the surrounding area (including Buildings 4468 and 4020). According to Rocketdyne, the principal contaminant of concern was identified as being Cs-137. The survey report indicated that "no other significant isotopes were found in the environment or soil without the adjoining presence of Cs-137." Soil sample analysis was performed for all potential radionuclides of concern, including gamma emitting radionuclides, Sr-90, Am-214, and isotopic plutonium, thorium, and uranium.

  The survey included a direct qualitative scan (100%) for surface gamma exposures, ambient gamma exposure rates at 1 meter above the ground, and soil sampling. The survey concluded that the site was acceptable for unrestricted use and could be released without radiological restrictions.

  The report summarized that the average surface exposure rates were 2.3 µR/hr for Class 1, 3.2 µR/hr for Class 2, and 2.3 µR/hr for Class 3.[4] The NRC limit was 5.0 µR/hr above background. The average ambient exposure rates ranged from 0.7 to 1.4 µR/hr, where the NRC limit was also 5.0 µR/hr above background. The nominal background exposure rates were measured at locations surrounding the Building 4030 area. The average background was 13.3 µR/hr.[5]

  Soil samples for Cs-137 showed an average level of 0.22 pCi/g and a maximum of 4.8 pCi/g. The Cs-137 derived concentration guideline limit ($DCGL_w$) was identified in the survey report to be 9.2 pCi/g above background. Soil samples for Th-228, Th-230, and Th-232 showed a maximum of 2.86 pCi/g, 1.38 pCi/g, and 2.68 pCi/g, respectively. The $DCGL_w$ for Th-228, Th-230, and Th-232 was identified in the survey report to be 5 pCi/g for each.[6]

  There were thirteen Pu-238 analyses, four Pu-239 analyses, one U-238 analysis, and one Sr-90 analysis. According to the survey report, plutonium results appeared somewhat elevated in comparison to the expected background levels. The Sr-90 sample was significantly higher than background at 22 pCi/g. While re-analysis of the same indicated 0.54 pCi/g, the area was remediated. The survey did not indicate the area requiring remediation or how the area was remediated. Rocketdyne requested reanalysis of the 18

[1] Lupo, Roger, *Confirmatory Survey of Building T020 Concrete Blocks and Other Building Debris, Santa Susana Field Laboratory*, September 17, 1998.
[2] Lupo, Roger, *Confirmation Survey of Building T020 Concrete Blocks and Other Building Debris, Santa Susana Field Laboratory*, March 26, 1999.
[3] Lupo, Roger, Confirmation Survey of Building T020 Concrete Blocks and Other Building Debris, Santa Susana Field Laboratory, September 27, 1999.
[4] According to the report, the average surface background level of 15.4 µR/hr was subtracted from the maximum surface exposure level to establish the above-listed results.
[5] Boeing, Document No. RS-00010, *Area 4020, MARSSIM Final Status Survey Report,* October 31, 2000.
[6] Boeing, Document No. RS-00010, *Area 4020, MARSSIM Final Status Survey Report*, October 31, 2000.

samples and the re-analysis showed most samples to be either non-detects, or significantly less than the original set of results.[1]

- **1997, 1998, & 1999 ORISE Verification Surveys**. On the dates of October 1, 1997, September 28, 1998, and October 28, 1999, ORISE performed a verification survey of Building 4020 and the surrounding area (including Building 4468 and 4720). The surveys were performed during three phases. Building 4020 had not been completed remediated during Phases I and II of the surveys in 1997 and 1998; however, Rocketdyne requested the surveys to be performed on the building footprint and septic trench to allow the areas to be backfilled prior to the start of the rainy season. The final survey used the final status survey methodologies contained in MARSSIM, classifying areas of the site as Class 1, 2, or 3 based on the history of radioactive material use.[2]

  During Phases 1 and II of the verification survey, the measurements and sampling locations were referenced to a 10-by-10-meter grid system established by ORISE. During Phase III, the grid system had been modified to be consistent with Rocketdyne's established 200-by-200-foot grid system.

  The survey included a 100 percent direct surface scan for gamma activity of the entire former Building 4020 facility. The survey also included exposure rate measurements at one meter above the surface at 26 locations, and soil samples were collected from a total of 42 locations within the former Building 4020 land area. Samples and data were sent to ORISE's ESSAP laboratory in Oak Ridge, Tennessee, for analysis and interpretation. The radionuclides of interest, according to the report, were uranium and mixed fission and activation products; however gamma spectra were also reviewed for other identifiable photopeaks. Composite samples from the Phase I survey were analyzed for strontium and isotopic plutonium.[3]

  The survey report concluded the site satisfied the DOE guidelines for release without radiological restrictions. The surface scan did not identify any locations of direct radiation in excess of "ambient background levels," which had been measured previously in 1996. The exposure rates, including background, ranged from 10 to 18 µR/hr compared to a background level of 14 µR/hr, which was reported to be below the NRC limit of 5 µR/hr above background and the DOE limit of 20 µR/hr above background. The report did not provide information to indicate how the background level of 14 µR/hr had been determined for the SSFL.[4]

  Minimum detectable concentrations of the following radionuclides were detected in soil samples: Am-241, Co-57, Co-58, Co-60, Cr-51, Eu-152, Fe-59, Mn-54, Sb-124, U-235, Sr-90, Pu-238, Pu-239, and Zn-65. Cs-137 ranged from less than 0.1 to 0.4 pCi/g in soils and Ra-226 ranged from less than 0.4 to 1.2 pCi/g. Th-232 ranged from less than 0.9 to

[1] Boeing, Document No. RS-00010, *Area 4020, MARSSIM Final Status Survey Report*, October 31, 2000.
[2] ORISE, Document No. ORISE 2000-1524, *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, December 2000.
[3] ORISE, Document No. ORISE 2000-1524, *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, December 2000.
[4] ORISE, Document No. ORISE 2000-1524, *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, December 2000.

1.8 pCi/g and U-238 was detected at concentrations less than 2.3 pCi/g. All four of the above radionuclides measured below their respective guidelines, which were reported to have been approved by DOE and the State of California. These guidelines are presented in the table below as provided in the 2000 survey report:[1]

Generic Limits for Soil and Water
Santa Susana Field Laboratory (ORISE, 2000)

Radionuclide	Soil Guidelines (pCi/g)	Water (pCi/l)
Am-241	5.44	1.5
Co-60	1.94	200
Cs-134	3.33	75
Cs-137	9.20	110
Eu-152	4.51	840
Eu-154	4.11	570
Fe-55	629,000	9,000
H-3	31,900	20,000
K-40	27.6	290
Mn-54	6.11	2,000
Na-22	2.31	480
Ni-59	151,000	26,000
Pu-238	37.2	1.7
Pu-239	33.9	1.6
Pu-240	33.9	1.6
Pu-241	230	80
Pu-242	35.5	1.6
Ra-226	5 and 15[a]	4.1
Sr-90	36.0	8
Th-228	5 and 15[a]	6.8
Th-232	5 and 1[a]	2.0
U-234	30[b]	
U-235	30[b]	Total uranium 20[b]
U-238	35[b]	

[a]DOE Order 5400.5 limits were proposed (5 pCi/g averaged over first 15 cm of soil depth and 15 pCi/g averaged over 15 cm layers below the top 15 cm.
[b]Generally more conservative NRC limits for uranium isotopes were proposed.

- DHS performed verification sampling in October 1999. However, the research team has been unable to find the report detailing this sampling. Therefore, the results of this sampling effort are unknown at this time.

Radiological Use Authorizations: Building 4020 was included in Special Nuclear Materials License No. SNM-21. The first license issued by the U.S. Atomic Energy Commission (AEC) for the SSFL site was Special Nuclear Material License No. SNM-21. License No. SNM-21 authorized Atomics International Division of North American Aviation, Inc. (Atomics International) 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 eight times to increase the number and type of nuclear materials that could be handled at the Canoga Park and SSFL sites.

[1] ORISE, Document No. ORISE 2000-1524, *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*, December 2000.

This license was terminated on September 27, 1996. The license required that all potentially contaminated liquid effluents from Building 4020 be analyzed prior to discharge.[1,2]

Former Radiological Burial or Disposal Locations: As indicated above, during initial construction, the facility radioactive drain was connected to two 500-gallon holdup tanks that were located in the north end of the basement. One of the tanks was designed for high-level waste and the other for low-level waste. Following an incident whereby these tanks overflowed, the system was modified by removing the 500-gallon tanks and the installation of the 3,000-gallon tank in Building 4468 in around 1970. After the new system had been put into place, the contents of these sumps were pumped into the Building 4468 holdup tank, discussed below.[3],[4] Available documents, to date, have not provided information regarding the disposal of the two tanks located in the basement. Building 4468 was located to the east of the Hot Laboratory at the perimeter fence line.[5,6]

According to the 1984 license renewal application, an attempt was made to absorb or solidify all highly contaminated waste in the cell at the time of generation. The license renewal application indicates that "suitable materials" including Bentonite clays were used to form solid waste. As a result, "most of the tank contents" was generated during decontamination, using water. A weir box was used to catch large particles prior to their entering the holdup tank.[7] In Cell 1, the metallographic cell, highly acidic and basic solutions were used. A 5-gallon baffle tank separated coarse particles from the liquid prior to release to the holdup tank.[8]

Solid wastes that remained after the decladding of spent reactor fuel for the DOE was sealed in drums and shipped to the RMHF for handling and ultimate disposal at an authorized burial site. Contaminated solid wastes from other licensed activities were accumulated in drums and disposed of by shipment to a burial site authorized by Rockwell or were returned to the customer for burial under their license.[9] The frequency of the movement of the drums to the RMHF is unknown and documents do not provide information to indicate where the drums were stored prior to removal from Building 4020.

Aerial Photographs: In 1952, the area comprising the future Building 4020 area is agricultural land. Beginning in 1957, the area surrounding the future Building 4020 locations is becoming developed. By 1959 the building is present and is surrounded by possible outside storage to the north of the building and outside storage to the west of the location at the location of the hold yard for incoming casks. A parking lot is located south of the building and the building is bordered on the east by 24th Street. Few changes are visible in 1965 and 1967 with the exception

[1] U.S. Nuclear Regulatory Commission, *Materials License*, SNM-21, September 15, 1977.
[2] U.S. Nuclear Regulatory Commission, NUREG-1077, *Environmental Impact Appraisal for Renewal of Special Nuclear Material License No. SNM-21*, June 1984.
[3] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[4] Boeing, Document No. RS-00010, *Area 402 MARSSIM Final Status Survey Report*, October 31, 2000.
[5] Boeing, Document No. RS-00010, *Area 402 MARSSIM Final Status Survey Report*, October 31, 2000.
[6] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[7] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[8] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[9] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

of the presence of a trailer located to the east of the building. By 1972, the trailer is no longer visible, but Building 4468 has been constructed to the east of the building. The aerial photograph interpretation makes note of the presence of a possible horizontal tank and possible vertical tank north of Building 4020. These remain visible in 1978, as well as the continued use of the western side of the building for outside storage. In 1980, at the northwest corner of the building, outside storage is visible with possible staining of the pavement. The area remains unchanged until 1988 when increased operations are visible surrounding the building. Numerous vehicles are located at the parking lot, outside storage is visible to the west and north of the building, and a trailer is located on the east side of the building between Buildings 4020 and 4468. By 1995 the area surrounding Building 4020 does not appear to be very active, with the exception of crates located at the northwest corner of the building and the presence of some light outside storage activities at the southwest end of the building. The building is reported to have been removed between 1995 and 1998, and by 2005 the area has been leveled and is vegetated.[1]

Radionuclides of Concern: Building 4020 handled a number of radionuclides including uranium, plutonium, thorium, and promethium. Decay products from U-235, U-238, and Th-232 decay chains include Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi212, and Tl-208. In addition, H-3, Sr-90, Cs-137, Na-24, Co-57, Co-60, Eu-152, and Am-243 would have been formed. All radionuclides of concern listed, with the exception of Na-24 and Co-57 (due to relatively short half-lives), are included in the EPA August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

Drainage Pathways: Historical photos indicate that surface water run-off from Building 4020 flowed either into the ditch on the south side of G Street or into the ditch on the south side of J Street. Currently, the majority of the surface water run-off drains to the north-northeast, into the ditch on the south side of G Street, then east into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4020 area is Class I because of previous site use, incident reports, and radioactive material use during building operations.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4020 area. As discussed above, there were numerous radiological incidents at Building 4020 and documented evidence of radiological releases.

In addition, previous characterization studies for the Building 4020 area were focused on delineating the extent of contamination to standards that were applicable at the time. Additionally, characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4020 area. This includes the following Building 4020 areas and appurtenances:

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

- The former Building 4020 footprint is recommended for sampling to characterize the existing fill material and the underlying soil (>18 feet below ground surface). Specifically, sampling locations should be focused to areas with the greatest potential for release such as in the vicinity of former hold up tanks, sumps, and drain lines.

- The former location of the leach field and septic tanks are recommended for sampling.

- The western boundary of the Building 4020 footprint and the boundary of the paved areas to the west of the building are recommended for sampling. These areas were known to be contaminated as a result of the handling of casks and other storage containers that were transported into and out of Building 4020.

- The alignment of the former pipeline leading from the Building 4020 basement through the transfer tunnel to Building 4468 should be sampled for potential residual contamination. Like the Building 4020 footprint, the transfer tunnel was removed during demolition of the building and the area was excavated to a depth of between 10 and 18 feet. The area was subsequently backfilled.

- Aerial photographs indicate the presence of stains at the northwest corner of the Building 4020 area boundary. This area, if not disturbed during demolition activities, may show elevated levels of contamination.

- As a result of documented releases of radioactive materials outside of the building, the drainage channels along G, J, and 24th Streets are recommended for sampling. Surface water run-off from Building 4020 flowed either into the ditch on the south side of G Street or into the ditch on the south side of J Street.

- The former paved areas to the north of the former building are recommended for sampling. As was documented in incident report A0016, on May 31, 1962, a portable radioactive liquid holdup tank was being filled from the radioactive holdup tank inside Building 4020 when the portable tank overflowed and a maximum of 50 gallons of liquid was spilled. The spilled liquid flowed down slope to the road and then to a drainage ditch. A similar incident occurred on November 24, 1964, when a radioactive spill resulting from the overflow of a 500-gallon portable liquid holdup tank occurred in the north loading dock area of Building 4020. A maximum of 25 gallons of liquid was lost at the north loading dock area and resulted in contamination of the immediate area.

2.2.2 Building 4468 Area

Site Description: The Building 4468 area includes Building 4468 and the surrounding area. Constructed in approximately 1970, Building 4468 housed a 3,000-gallon waste holdup tank that was connected to Building 4020. Other buildings within the vicinity of Building 4468 included Building 4020 to the west and Building 4055 located to the east across 24th Street. Figures 2.2.2a through 2.2.2g provide a current photograph and the best available building-specific drawing(s) and photographs that the research team could find. Plate 1 presents a summary of all identified features for this site.

Building Features: Building 4468 was located adjacent to and at a slightly lower elevation than the Hot Laboratory building, Building 4020. It was a 10-foot by 22-foot by 20-foot aboveground cinderblock building with a steel roof. The building also consisted of a 12-foot below-grade structure of poured concrete. During operation, the building was prone to occasional groundwater seepage that would fill the facility sump and overflow onto the floor.[1]

The building housed an underground 3,000-gallon liquid waste holdup tank connected to Building 4020 thru a radioactive drain system. All of the radiologically controlled areas within Building 4020 were connected to the drain system that terminated in the Building 4468 holdup tank (see Figures 2.2.2b and 2.2.2d). The Building 4020 radioactive drain system consisted of several drain lines that drained each of the controlled areas, including the hot cells, decontamination rooms, service gallery, hot support rooms, hot change room, and basement. The system was an all-butt-welded stainless steel piping system that joined in the basement and flowed through a double-walled pipe to the Building 4468 holdup tank. The drain lines were embedded in the support-area concrete slab and the rebar-reinforced concrete between the main floor of Building 4020 and the basement. The basement of Building 4020 contained a drain subsystem that drained into three sumps (described above in Section 2.2.1), one at each end of the basement and one near the center. The contents of these sumps were automatically pumped into the Building 4468 holdup tank through a 30-foot long, 2-foot diameter utility tunnel (see Figures 2.2.2b and 2.2.2d).[2]

The inlet at the top of the Building 4468 holdup tank was preceded by a weir that trapped much of the sediment that had been transported down the drain lines. A 4-inch drain line at the inlet to the weir and tank connected to the west wall of Building 4020. During decommissioning, remote video cameras were used to inspect the line and it was noted that centering lugs were welded to the pipe to connect the pipe to an outer secondary containment casing.[3]

The tank was also connected to an underground 2-inch diameter pipe that was used to transfer contaminated waste water from the 3,000-gallon tank to a 500-gallon portable transfer tank loading station. The pipes, unlike the facility radioactive drain lines, were not welded stainless steel, but were a combination of black iron and galvanized pipe. According to the 2001 decontamination and dismantlement report, the pipes degraded through electrolysis between the two different types of pipe material. The result was the contamination of approximately 30 cubic yards of soil on the west side of Building 4468; however, available documents do not indicate the duration of the contaminating activities or how much waste was lost through the degraded pipes. Information regarding the removal of contaminated soil in this area in 1995 is discussed below.[4]

Former Use(s): According to the 2000 final status survey document, Building 4468 was added to the Hot Lab facilities in approximately 1970 to contain a new radioactive liquid waste holdup tank in a pit at the east side of Building 4020. The building was constructed to support the operations of Building 4020 by receiving and storing radioactive effluent generated by the operations of the Hot Lab. As indicated above, when Building 4020 was originally constructed, the facility radioactive drain was connected to two 500-gallon holdup tanks located in the north

[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[3] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[4] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.

end of the basement. An unknown incident involving the overflow of one of the tanks documented in the final decontamination and dismantlement report resulted in the construction of a new 3,000-gallon tank in Building 4468 for increased storage capacity. The new tank reduced radiation exposure to personnel working in the basement area, and the new system contained and controlled larger quantities of radioactive wastewater.[1]

The 3,000-gallon liquid waste tank was removed from the building during the 1994 fiscal year after the drainage system was removed from Building 4020. The tank was wrapped in plastic and transported to the RMHF where it was place in interim storage in a below-grade shielded vault for "later removal of the remaining sludge and debris, size reduction, and packaging for disposal." Rockwell International initiated the decontamination and demolition of Building 4468 with the removal of the steel roof, the wash-down of interior surfaces with a high-pressure spray, and the removal of all loose contamination and liquid waste generated during the cleaning process. The interior surfaces were surveyed (discussed below), and the lower 12 feet of all wall surfaces were sealed with ALARA paint to fix remaining surface contamination in place. A contractor was hired to excavate the soil surrounding the building and to saw-cut and demolish the facility. The above-grade portions of the walls were saw-cut first and placed in roll-off containers for "off-site" disposal. The soil surrounding the remaining structure was excavated to a depth of 4 feet, and a series of 3-inch diameter holes were cored through the concrete walls for removal. The contractor then excavated a trench around the building to the base of the structure. During excavation, the soil was surveyed in 2-foot increments and was determined to be radiologically clean (survey results presented below).[2] A construction change request indicated that the removed soil surrounding Building 4468 was transported in an ETEC dump truck to the "other side of the yard" for sampling. The change request did not define the "other side of the yard."[3] Available documents do not indicate whether the soil was backfilled into the excavation or disposed off site. Upon receipt of additional documents from Boeing's 1.4 million document database, additional information regarding the removal of this soil may be located.

The contractor saw-cut the excavated wall structure from the outside, leaving an approximately ¼-inch thickness uncut at the interior surface to "ensure that the cutting water did not become contaminated." The individual wall segments were supported using the Rocketdyne mobile crane and a sling through one of the holes while the bottom horizontal cut was made. The cut segment was snapped off and moved to an unidentified staging area where it was "double-wrapped in plastic for contamination control." Twenty-seven wall and floor slab sections were cut and transferred to the RMHF for staging and shipment to a DOE-approved disposal site. The source document does not state what the final DOE-approved disposal site was.[4]

DOE approved the removal of Radioactive Material Management Area for the Hot Lab facility in November 1998, which included the holdup tank and leach pits.[5]

During demolition activities, the contractor removed soil surrounding Building 4468 and transported the soils in an ETEC dump truck to the "other side of the yard" for sampling. The

[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[3] Unknown, *Construction Change Request (I) G.D. Heil Inc. Building 468/B020 Yard*, Date Unknown. HDMSE00233388.
[4] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[5] Lopez, M., Letter Re: Removal of RMMA Designation for B020, November 13, 1998.

contract was instructed to remove 4 feet of soil at a time to allow saw cutting of the concrete walls in 4- by 4- by 1-foot slabs. The crane to lift the blocks was provided by ETEC and ETEC engineering designed the configuration of the size of the blocks and "lifting core hole." This work was to be completed in parallel with the excavation of the abandoned septic tank and abandoned leaching system. According to the demolition proposal, the area around the perimeter of Building 4468 was to have been excavated 3 feet wide and to a depth of 12 feet. The area of the septic tank and abandoned leaching system were to have been excavated 20 feet wide and to a depth of 12 feet. Similar to Building 4020, the Building 4468 excavation was filled with 6 inches of sand prior to backfilling with on-site material.[1] The Building 4020 leaching system and septic tank system are discussed above in Section 2.2.1.[2]

Information from Interviewees: None, to date.

Radiological Incident Reports: There have been two reported incidents associated with Building 4468; however, neither incident resulted in a release to the environment. The following table provides information presented in an incidents database provided by Boeing.

Building 4468 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0325	8/16/1982	LIQUID WASTE BL		RAS Alarm Response At RIHL Radioactive Liquid Waste Bldg.
A0213	12/17/1990	T468 RADIOACTIVE LIQ BL		False Reading On RAS Detector Caused Alarm.

Current Use: According to the 1998 Site Environmental Report, Boeing completed D&D activities of the Hot Lab in 1998 with the removal of Building 4468. During demolition, Boeing determined the inside of Building 4468 was contaminated, although the soil surrounding the building was not. Rocketdyne, ORISE, and the California DHS samples the soil within the excavation to verify no contamination remained prior to backfilling the excavated areas, which was completed prior to the 1998/1999 rainy season.[3] On January 31, 2005, DOE declared that Boeing and ORISE surveys confirmed that the Building 4020 site, including Building 4468, was suitable for release for unrestricted use.[4]

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

- **1996 Boeing Soil Removal.** In 1996, approximately 30 cubic yards of contaminated soil was removed from the area between Building 4020 and Building 4468. The depth of removal was not located in the report, nor did the report indicate how the soil was disposed. The source of contamination was an underground 2-inch diameter pipe that has

[1] McLain, Steve, G.D. Heil, Inc., Demolition Contractors Letter Re: Excavation and Sawcutting at Building 468, Santa Susana Field Lab, Ventura County, CA, June 11, 1998.
[2] Unknown, *Construction Change Request (I) G.D. Heil Inc. Building 468/B020 Yard*, Date Unknown. HDMSE00233388.
[3] Boeing, RD99-115, *Site Environmental Report for Calendar Year 1998 DOE Operations at Rocketdyne Propulsion & Power*, September 22, 1999.
[4] Lopez, M., Letter Re: Release of Building 4020, January 31, 2005.

been used to transfer contaminated waste water from the 3,000-gallon tank to the 500-gallon portable transfer tank loading station.[1]

- **1996 Rocketdyne Area IV Radiological Characterization Survey**. During the 1996 Area IV Radiological Characterization Survey, soil samples were taken at one location in the vicinity of Building 4468. None of the measurements were distinguishable from background and all measurements were below the acceptable concentration levels established by Boeing.[2]

- **1997 Boeing Final Status Survey.** In 1997, two hundred and sixteen surface and subsurface soil locations were sampled following the removal of the concrete basement area of Building 4020. The samples were analyzed by gamma spectroscopy for elevated concentrations of Cs-137. The sampling included two samples from a trench on the west side of Building 4468 and one sample from the northern side of the "liquid waste facility," which is also believed to be Building 4468. Both samples from the trench were subsurface samples taken approximately 8 feet below ground surface while the sample from the northern side of the building was a surface sample. One of the subsurface samples measured 0.03 pCi/g for Cs-137 and the surface sample measured 0.02 pCi/g for Cs-137. The report indicated that all samples were below Boeing's clean-up standard of 9.2 pCi/g.[3]

- **1998 Boeing Radiation Survey of Excavated Soil.** On August 3, 1998, Boeing reported the results of a radiation survey performed on samples from excavated soil from Building 4468. During the soil excavation at Building 4468, Boeing collected one soil sample from approximately every 10 cubic feet of excavated soil, resulting in 195 soil samples. Each soil sample was measured using a one-minute count with a 1-by1-inch sodium iodine (NaI) detector. The measurement results ranged from 1,897 to 2,197 counts per minute (cpm) with a mean value of 1,990 cpm. To determine background, Boeing collected a sample approximately 150 feet west of the excavation area in "an area unaffected by Building 20 operations." Ten measurements were taken and the mean background soil measurement was 2,013 cpm.

- **1998 Boeing Soil Sampling.** During the demolition of Building 4468, Boeing analyzed 13 soil samples to determine the need to remediate contaminated soil and to "pre-release" the facility. The sampling included only gamma spectrometry and, as a result, only gamma emitting radionuclides were identified for the sampling locations. The results showed that all samples were below the site-wide release limit for Cs-137 of 9.2 pCi/g as well as below local fallout levels. ORISE and the DHS/Radiological Health Branch (RHB) also sampled the soil remaining in the cavity following demolition activities. Both agencies reported all sample results were below typical background concentrations that were lower than the 1998 cleanup standards.[4]

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[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Rocketdyne, Report A4CM-ZR-0011, "Area IV Radiological Characterization Survey Final Report," August 15, 1996.
[3] Boeing, RS-00010, *Area 4020 MARSSIM Final Status Survey Report*, August 31, 2000.
[4] Boeing, RD99-115, *Site Environmental Report for Calendar Year 1998 DOE Operations at Rocketdyne Propulsion & Power*, September 22, 1999.

- **1998 Boeing Soil Sample Survey.** Boeing performed a soil sample survey in 1998 on samples from excavated soil from Building 4468 and the septic columns and leach field associated with Building 4020. During soil excavation, one soil sample was taken from approximately every 10 cubic feet of excavated soil, resulting in 195 soil samples. Measurements of activity ranged from 1,897 to 2,194 cpm compared with an average background measurement of 2,013 ± 50 cpm. Most soil samples were less than the minimum detectable activity of 0.02 pCi/g for Cs-137, with the highest measurement being 0.21 pCi/g (Cs-137 $DCGL_w$ is 9.2 pCi/g).[1]

- **1999 Rocketdyne Final Status Survey.** Rocketdyne performed a MARSSIM final status survey in September 1999, of the Hot Lab facility and the surrounding area (including Buildings 4468 and 4020). According to the report, the principal contaminant of concern was Cs-137. The report also included soil sample analysis for all potential radionuclides of concern, including gamma emitting radionuclides, Sr-90, Am-241, and isotopic plutonium, thorium, and uranium.

  The survey included a direct qualitative scan (100%) for surface gamma exposures, ambient gamma exposure rates at 1 meter above the ground and soil sampling. The survey concluded that the site was acceptable for unrestricted use and could be released without radiological restrictions. The average surface exposure rates, adjusted for background, were 2.3 µR/hr for Class 1, 3.2 µR/hr for Class 2, and 2.3 µR/hr for Class 3. At this time the NRC limit was 5.0 µR/hr above background. The average ambient exposure rates ranged from 0.7 to 1.4 µR/hr, where the NRC limit was also 5.0 µR/hr above background). Soil samples for Cs-137 showed an average level of 0.22 pCi/g and a maximum of 4.8 pCi/g. The Cs-137 $DCGL_w$ is 9.2 pCi/g above background.[2]

- **1999 ORISE Verification Survey.** As summarized in the Building 4020 investigations section, in October 1999, ORISE performed a verification survey of Building 4020 and the surrounding area (including Building 4468 and 4720). The survey included a direct surface scan, exposure rate measurements and soil samples. The survey concluded the site satisfies the DOE guidelines for release without radiological restrictions. The surface scan did not identify any locations of direct radiation in excess of ambient background levels. The exposure rates, including background, ranged from 10 to 18 µR/hr compared to a background level of 14 µR/hr, which is below the NRC limit of 5 µR/hr above background and the DOE limit of 20 µR/hr above background. Minimum detectable concentrations of the following radionuclides were detected in soil samples: Am-241, Co-57, Co-58, Co-60, Cr-51, Eu-152, Fe-59, Mn-54, Sb-124, U-235, Sr-90, Pu-238, Pu-239, and Zn-65. Cs-137 ranged from < 0.1 to 0.4 pCi/g in soils and Ra-226 ranged from < 0.4 to 1.2 pCi/g. Th-232 ranged from < 0.9 to 1.8 pCi/g and U-238 was detected at concentrations less than 2.3 pCi/g. All four of the above radionuclides measured below their respective guidelines.[3]

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[1] Shao, J., and Barnes, J., Letter Re: Soil Sampling Results for Building 468 and 020 at SSF," August 3, 1998.
[2] Boeing, RS-00010, "Area 4020, MARSSIM Final Status Survey Report," October 31, 2000.
[3] ORISE, Document ORISE 2000-1524, "Verification Survey for the Land Area Formerly Surrounding the Hot Laboratory (4020), Santa Susana Field Laboratory, The Boeing Company, Ventura County, California," December 2000.

- **2001 Hot Laboratory Decontamination and Dismantlement Final Report.** According to this report, the highest level of radioactive material found during the decommissioning activities were in the radioactive drain system running from each of the cells in Building 4020 to a header that connected to the Building 4468 radioactive water holdup tank. The report did not provide data to indicate what the levels were, but stated the contamination consisted primarily of old mixed fission products (Cs-137, Sr-90, Pm-147), Co-60, small amounts of uranium, and trace amounts of plutonium.[1]

Radiological Use Authorizations: Building 4468 operated under NRC Special Nuclear Materials License No. SMN-21.

Former Radiological Burial or Disposal Locations: There are no radiological burial or disposal locations associated with Building 4468. The building, itself, served as the location of a new radioactive liquid waste holdup tank in a pit at the east side of Building 4020. The building was constructed to support the operations of Building 4020 by receiving and storing radioactive effluent generated by the operations of the Hot Lab.[2]

Aerial Photographs: In 1952, the area comprising the future Building 4468 area is agricultural land. Beginning in 1957, the area surrounding the future Building 4468 location is becoming developed. By 1959 Building 4020 is present. Few changes are visible in 1965 and 1967 with the exception of the presence of a trailer located to the east of Building 4020 at the future location of Building 4468. By 1972, the trailer is no longer visible, and Building 4468 has been constructed to the east of the building. Few features are visible surrounding Building 4468 in subsequent photographs until 1988, when a trailer is located on the west side of the building between Buildings 4020 and 4468. The building is reported to have been removed between 1995 and 1998, and by 2005 the area has been leveled and is vegetated.[3]

Radionuclides of Concern: Building 4020 handled a number of radionuclides including uranium, promethium, thorium, and plutonium. Accordingly, these radionuclides and their decay products may have entered the Building 4468 tank. Decay products from U-235, U-238, and Th-232 decay chains include Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi212, and Tl-208. In addition, H-3, Sr-90, Cs-137, Na-24, Co-57, Co-60, Eu-152, and Am-243 would have been formed. All radionuclides of concern listed, with the exception of Na-24 and Co-57 (due to relatively short half-lives), are included in the EPA August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

Drainage Pathways: Historical photographs indicate that surface water run-off from the vicinity of Building 4468 drained either into the ditch on the south side of G street or into the ditch on the south side of J Street. Currently, surface water drains from the vacant land to the east-northeast and then into the ditch on the south side of G Street.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4468 area is Class 1 because of the building's proximity to Building 4020 and the buildings use as a holdup tank.

[1] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[2] Boeing, EID-06141, "Hot Laboratory Decontamination and Dismantlement Final Report," November 27, 2001.
[3] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4468 area. Previous characterization studies for the Building 4468 area were focused on delineating the extent of contamination to standards that were applicable at the time. Additionally, characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4468 area. This includes the following Building 4468 areas and appurtenances:

- Similar to Building 4020, the former Building 4468 footprint is recommended for sampling to characterize the existing fill material and the underlying soil. Specifically, sample locations should be focused at locations where potential releases of liquids may have occurred such as holdup tanks, septic system, and drainage pipe lines. Drainage ditches to the east along 24 Street and north along G Street are recommended for sampling.

2.2.3 Parking Lot 4520 Area

Site Description: The Parking Lot 4520 Area comprises Parking Lot 4520 and the surrounding area. This area is located west of 24th Street south of Building 4020. Parking Lot 4520 was constructed between 1957 and 1959. Figures 2.2.3a and 2.2.3b 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: There are no building features to report for Parking Lot 4520.

Former Use(s): Parking Lot 4520 appears to have been mainly used for its intended purpose as a parking area.[1] However, in 1996 during removal of the Building 4020 floor slab cut slab sections were removed, numbered, and stacked in the parking lot where the slabs were to be surveyed and prepared for disposal. The length of time the slabs were stored at this location was unreported.

Information from Interviewees: No information regarding the Parking Lot 4520 area has been obtained from interviewees, to date.

Radiological Incident Reports: There have been no incidents associated with Parking Lot 4520 identified in historical records obtained, to date.

Current Use: Parking Lot 4520 was removed in 1996 as part of the Building 4020 D&D effort. Aerial photographs show the area to be vegetated now.[2]

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

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

- **1999 Class 2 Survey.** In September 1999, Parking Lot 4520 was included in the Class 2 area survey unit of Building 4020. The Class 2 area survey unit included the parking lot and the roadway to the east of Building 4020. According to the survey, the average gross surface walk-about exposure level was 3,250 counts per minute or 15.1 µR/hr. The maximum surface walk-about exposure level observed as 4,000 cpm or 18.6 µR/hr. The average surface background level established for the area in 1999 was 3,311 cpm or 15.4 µR/hr, resulting in these results being below the approved derived concentration guideline ($DCGL_w$) of 5 µR/hr above background.[1]

Radiological Use Authorizations: There are no Use Authorizations associated with Parking Lot 4520.

Former Radiological Burial or Disposal Locations: There are no documented radiological burial or disposal locations at or surrounding Parking Lot 4520.

Aerial Photographs: Parking Lot 4520 is first visible in 1959 aerial photographs. In 1959, the parking lot appears to be constructed at a slightly higher elevation than Building 4020, to the north. There are numerous vehicles parked during this time period. In 1962 the area remains relatively unchanged. An area west of the parking lot appears to be undergoing development in 1967; however, the grading activities appear to cease and by 1972 the area is again vegetated. The area remains unchanged until 1995 with the appearance of a path from the southeast corner of the parking lot to an area south of the parking lot. There is also an area of disturbance southeast of the parking lot along the west side of 24th Street that includes an excavation, light-toned mounded material and mounded material with scattered vegetation. By 2005, Parking Lot 4520 has been removed and the area is vegetated. The 1995 area of disturbed ground southeast of the parking lot is also vegetated.[2]

Radionuclides of Concern: There are no radionuclides of concern associated with the parking lot; however, Building 4020 handled a number of radionuclides including uranium, thorium, and plutonium. Decay products from U-235, U-238, and Th-232 decay chains include Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi212, and Tl-208. In addition, H-3, Sr-90, Cs-137, Na-24, Co-57, Co-60, Eu-152, and Am-243 would have been formed. All radionuclides of concern listed, with the exception of Na-24 and Co-57 (due to relatively short half-lives), are included in the August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

Drainage Pathways: According to a 1969 plot plan, drainage surrounding the Parking Lot 4520 Area appears to be the northwest. Historical photos indicate that surface water run-off from Building 4020 flowed either into the ditch on the south side of G Street or into the ditch on the south side of J Street. Currently, surface water drainage in the vicinity of the former Parking Lot 4520 is to the northeast into a 24 inch culvert which flows east, under 24th Street. Surface water then runs along the south side of J Street into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Parking Lot 4520 area is Class 1 because of the parking lot's proximity to Building 4020.

[1] Boeing, Document RS-00010, *Area 4020 MARSSIM Final Status Survey Report*, October 31, 2010.
[2] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

There is the potential of radioactive material migration via surface water flow or airborne release from Building 4020. And there have been limited site investigations at Parking Lot 4520, and characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Parking Lot 4520 area. This includes the following Building 4317/4730 areas and appurtenances:

- The perimeter of the former Parking Lot 4520. Parking lots are generally constructed to have drainage flow to the perimeter of the structure. As a result, should radioactive materials have drained from facilities to the north to the parking lot, namely from Building 4020, residual contamination not consistent with the DTSC/DOE December 2010 AOC may exist.

- The area southeast of Parking Lot 4520. Unknown excavation activities appear in 1995 aerial photographs. The area of disturbed ground included light-toned mounded material and scattered vegetation. These activities occur at a time of numerous building demolition activities. Because of the unknown nature of these activities, it is recommended this area be included in field sampling activities. [1]

2.2.4 Building 4055 Area

Site Description: The Building 4055 area is located outside the ETEC boundary and includes the Nuclear Material Development Facility (NMDF) Building 4055, a guard shack (Building 4155), a substation (Building 4755) located within the southwest corner of Building 4055, and the surrounding area located on G Street. Building 4055 was constructed in 1967 to serve for specifically for development work involving plutonium. The building remains operational today for non-nuclear laser research.[2] It is a tilt up concrete structure that measures approximately 200 feet long, 60 feet wide, and 16 feet high.[3] Figures 2.2.4a through 2.2.4p 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: As indicated above, Building 4055 is a tilt up concrete structure 200 feet long, 60 feet wide, and 16 feet high. The building is constructed of noncombustible materials including windowless, precast, tilt-up concrete slab walls of 6-inch thickness and a concrete slab floor. The roof, consisting of lightweight concrete, tarred felt, and gravel, is supported on steel deck panels and girders. The portion of the building surrounding the posted area is sealed by Thiokol-filled concrete joints, painted concrete surfaces, weatherproofed doors, and "suitable partitions." The building is divided into an administrative area, change rooms, chemistry and other service laboratories, a glove box room, a vault, and facility equipment rooms (See Figure 2.2.4b and Figure 2.2.4c).[4,1]

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[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] It was noted by Boeing that these operations were estimated to stop in May 2011; however, confirmation that operations in Building 4055 have ceased has not been received.
[3] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[4] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.

The primary radioactive materials containment within the building was provided by the 30 boxes in the glove box system that was used to handle radioactive materials within a regulated environment (See Figure 2.2.4e). Secondary containment was provided by the portion of the building that included the glove box room, chemical support room, general support room, counting room, electronics shop, dark room, radioactive exhaust equipment room, and radioactive material storage vault. Air locks were provided at the main and rear entrances to the secondary containment area.[2,3,4]

The radioactive exhaust network consisted of three systems tied into the primary exhaust duct and stack and included continuous alpha monitoring. Each system had its own filter and comprised the primary ventilation system used for the glove box room and support lab area, the fume hood ventilation system used for fume hoods, and the glove box ventilation system used for the glove boxes and tunnel exhaust.[5]
[redacted][6] As indicated above, each glove box was connected to the low-volume exhaust system that, under normal conditions, maintained specified atmosphere pressure within the glove box. During emergency conditions, the exhaust system drew 150 cubic feet per minute through two glove ports with the gloves removed. The floors in the glove box room and chemical support laboratory had a polyvinyl covering to provide a surface that could be easily decontaminated.[7]

According to a July 22, 1968, internal letter regarding the in-box filter systems at Building 4055, the high-efficiency in-box filter systems for the glove box trains that were involved in the mixed oxide and carbide programs had some deficiencies with regard to nuclear material recovery, accountability, and safety. To maximize the potential for recycling fuel material and recovering scrap material, and to minimize the hazards associated with finely divided plutonium metal or carbide, it was recommended that the in-box filter system and operations be modified to:[8]

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[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

[2] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.

[3] Oak Ridge Associated Universities Report, no document number, *Confirmatory Radiological Survey Nuclear Materials Development Facility (Building T-055), Rockwell International, Santa Susana, California*, July 1987.

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

[5] Jones, L.J., Atomics International Document No. OP-001-99-001, *Plutonium Facility, Facility Emergency Plan for NMDF – SS 55*, June 18, 1969.

[6] [redacted]

[7] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

[8] Sayer, W.B., Atomics International Internal Letter Re: In-box Filter Systems at Building 055, July 22, 1968.

- "Install a pre-filter ahead of the present in-box high-efficiency filter in those boxes which may house particularly dusty operations, in order to increase the interval between high-efficiency filter changes and facilitate recycle and/or recovery of the fuel material."

- "Reduce the amount of inaccessible area and crevices in the vicinity of the recessed filter unit in order to minimize the potential for accumulation of particulates. This [could] be accomplished by relocation of the filter unit. . . Another method of reducing the amount of inaccessible area would be through the use of a gasket arrangement located at the face of the filter unit whose purpose would be to seal off the undesirable area between the wall of the recess area and the filter unit housing…"

- "Provide secondary in-box containment capability for operations which generate significant quantities of airborne particulates."

As indicated above, the glove boxes were connected to transfer tunnels, one provided for the fabrication line and another provided for the analytical line. According to the renewal application for the special nuclear materials license, each transfer tunnel included on air atmosphere glove box to receive materials to be transferred to one of the attached glove boxes. The lines each included on vacuum chamber to remove air from materials being transferred, and one argon glove box with two gloves to transfer materials from the vacuum chamber to a trolley. Both tunnels were connected to the low-volume exhaust system. Each also included one trolley for transporting material. As with the glove boxes, the atmosphere in the tunnels comprised either purified argon or air, and all atmosphere entering or leaving the tunnels passed through high-efficiency filters mounted inside the argon glove box.[1]

The building also included a Nuclear Material Storage Vault, Room 131 that was constructed of 9-inch thick, reinforced concrete walls, ceiling, and floor. The room had a vault-type door with a combination lock (See Figure 2.2.4f).[2]

Building systems included an air conditioning system that with temperature and humidity control, a radioactive liquid waste holdup system, an electrical power distribution system, an alarm and instrumentation system, fire control systems, and plumbing system. The building was reported to not require process water. Non-potable water was supplied for the restrooms and for janitorial purposes, and bottled water was supplied for drinking.[3]

The air conditioning system in Building 4055 comprised a dual ventilation and gaseous emission control system. One high-volume system was employed for air supply and exhaust in areas occupied by personnel. A separate low-volume system was used for the glove-box system atmosphere. Under normal conditions, the low-volume system was used only to exhaust the small quantities of glove-box atmosphere necessary to maintain a negative pressure with respect to the glove-box room.[4]

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[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Atomics International, AI-74-44, *Special Nuclear Material Control Program for Plutonium Use by Atomics International Division of Rockwell International in Research and Development Activities Under Special Nuclear Material License No. SNM-21*, May 24, 1974.
[3] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[4] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

Each glove box was equipped with manually actuated canisters to extinguish fires within the glove box. The building also included fire detection equipment that provided an automatic wet pipe sprinkler system in the office areas, mezzanine area, change rooms, support laboratories, glove-box room, and air conditioning equipment room.[1]

Fuel for the diesel engine in Room 132 was stored in a 1,000-gallon underground tank (UT-55) and an aboveground 50-gallon tank, both exterior to the building (see Figure 2.2.4g).[2,3]

The floor drains, service sinks, and laboratory sinks potentially capable of handling radioactive materials were connected to a radioactive liquid waste system by underground pipe to two 1,000-gallon holding tanks. The liquid waste holding tank and concrete retention well were located southeast of the building near Building 4373 (see Figure 2.2.4h).[4,5,6]
According to the 1987 final decommissioning report, a manually operated, three-way valve permitted selective discharge of the change room shower drains to either the liquid waste holding tank or to the sanitary sewer system. Normal position of the valves was to the liquid waste holding tank to accommodate emergency situations. According to the report, to eliminate the possibility of radioactive contamination entering the sanitary sewer system, the showers were restricted and used only for emergency purposes. Available documents do not provide information to indicate the showers were ever used or tested during the operation of the building.[7]

Potentially contaminated liquid wastes flowed through underground soil piping to the control tank installation (see Figure 2.2.4i, Figure 2.2.4j, and Figure 2.2.4k) that comprised a concrete vault measuring 15 by 20 feet. This facility was located within a fenced area just outside the southeast corner of Building 4055. Wastes first entered the hot waste clarifier tank (T-1) for removal of suspended solids through a 4-inch pipe that ran along the east wall of Building 4055 to approximately 17 feet from the building and then ran south for approximately 170 feet to the hot waste clarifier tank. A float-controlled pump (P-5) automatically transferred the clarified liquid to the 230-gallon receiver tank (T-2). When this tank was full, a sample was analyzed to determine whether radioactivity was present, and the contents were then manually discharged to one of the 1,000-gallon holdup tanks (T-3 and T-4) for future disposal. Final disposal from the holdup tanks was made by pumping (P-6) safe liquids through a 4-inch clay line to a surface drainage ditches that ran parallel to J Street. According to facility drawings, this system was contained within a concrete vault that measured 15- by 20 feet and was located inside a fenced area just outside the southeast corner of Building 4055. The 4-inch clay line is shown as being

[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Rockwell International, AI-76-21, *Environmental Impact Assessment of Operations at Atomics International Under Special Nuclear Materials License No. SNM-21*, April 30, 1976.
[3] Ogden Environmental and Energy Services Co., Inc., *Phase II Subsurface Investigation Underground Storage Tank UT-55 Building 055*, November 1997.
[4] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[5] Oak Ridge Associated Universities Report, no document number, *Confirmatory Radiological Survey Nuclear Materials Development Facility (Building T-055), Rockwell International, Santa Susana, California*, July 1987.
[6] Rockwell International Report, N001TI000200, *Long-Range Plan for Decommissioning Surplus Facilities at the Santa Susana Field Laboratories*, Date Unknown.
[7] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.

discharged to a drainage ditch that runs parallel to "J" Street. These drawings also show that the 4-inch 304 SST radioactive liquid waste pipe that feeds into the hold tanks runs along the east wall about 17 feet away, for about 170 feet until it discharges into the hold tanks.

According to this 1987 report, any contaminated liquids were solidified and disposed of at appropriate radioactive disposal sites. The report did not provide information to indicate how material from the tanks was solidified and removed prior to disposal. According to the report, each radioactive waste tank was equipped with two high-liquid-level transmitters connected in parallel that initiated an alarm at high liquid levels.[1]

Building 4055 includes a 480-square foot security control station, Building 4155, that was constructed to meet government security regulations on advanced fuel programs. A secured-access passageway, Room 136, was between the entry lobby and Room 138, and was referred to as the "manned station." Figure 2.2.4l shows a layout of Building 4155.[2]

Former Use(s): Building 4055, the NMDF, was designed and constructed in 1967 and operated by the Rocketdyne Division of Rockwell International for research, development, and production of nuclear fuels and radioactive sources. As described on the ETEC website:

> Building 4055 was constructed in 1967 specifically for development work involving plutonium, and incorporated all of the safety systems and safeguards required for such work. From 1968-69, NMDF was used to support the Fast Flux Test Facility through analytical chemistry and research for uranium-plutonium scrap pellet recycling programs. Fission research on microscopic dispersion of tungsten in uranium plutonium fuel was also conducted at that time. For seven months in 1970, the NMDF fabricated mixed uranium-plutonium oxide pellets for irradiation tests. The NMDF was in standby from September 1970 until March 1974. NMDF was activated to participate in the Advanced Fuel Systems Program for liquid metal fast breeder reactors and to demonstrate reduced transuranic (TRU) solid waste with the use of a molten salt combustor. In 1975, the facility was upgraded to address new environmental, safeguard, licensing and radioactive materials facility operating standards.

In May 1965, Rockwell International completed a planning report to propose the construction of the plutonium materials development facility. The report provided a description of operations that included the following:[3]

> Sealed containers of plutonium will enter the facility through the large air lock and will be placed in the storage vault until ready for use in the glove box area. The plutonium will then be removed from the vault and placed in the first glove box where it will be blended with graphite, agglomerated, and dried. The mixture will be transferred to the induction furnace box for carbothermic reduction to PuC. The reduced material will then be crushed and sized, and transferred to the next box where it will be arc melted.
>
> The resulting cast rods will be machined into fuel slugs or metallographic specimens. . . Once the fuel rods are machined they will be incapsulated in stainless steel jackets for

[1] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[2] Stafford, K.T., ETEC, *Site Consolidation Assessment*, April 16, 1987.
[3] deArrieta, J., et al., *Planning Report Plutonium Materials Development Facility Building 055, Santa Susana*, May 24, 1965.

> insertion into a reactor and irradiated. Wastes from the machining and melting operations will be re-processed or shipped for radioactive waste burial. . .
>
> All transfer of material into the glove box will be done by an electrical powered transfer cart. The material will be placed on the cart and moved into the glove box by means of a glove installed in the tunnel wall. Each box will have a leak tight door which can be opened from inside the glove box when the plutonium is being transferred. Removal of the contaminated material including waste scrap will be by special ports located on the side of the boxes. Every item will be packaged within the glove box, decontaminated, and then removed from the glove box through special ports called "bag out" ports.

A June 1966 license application for Building 4055 also indicated that the products of Building 4055 are solid reactor fuel materials including carbides, oxides, and other compounds such as nitrides and sulfides. Feed materials, according to the application, included oxides of plutonium and uranium and plutonium and uranium metal. The forms of fissionable materials stored or "in process" within Building 4055 were to include: plutonium oxide, uranium oxide, mixed plutonium-uranium oxide, plutonium metal, uranium metal, plutonium-uranium metal alloy, plutonium carbide, uranium carbide, and mixed plutonium-uranium carbide. The application indicated that while the scope of the facility research and development operation was intended to be flexible with regard to fuel choice, it was expected that emphasis in the research and development operations would be directed toward the fabrication of mixed carbides.[1]

Following the construction of the facility in 1967, operations began in 1968 on two programs in support of the U.S. Government's Fast Flux Test Facility. In 1970, the facility initiated a fabrication effort for the ANL. Both programs, according to a 1992 summary of Rockwell International's plutonium capabilities, involved mixed uranium-plutonium oxide fuel pellets. In July 1968, a new program was initiated to develop a technique to "introduce microquantities of tungsten into mixed uranium-plutonium carbide" with the goal of the tungsten acting as a nucleating site for fission gas.[2]

During the mid-1970s, the NMDF conducted two programs concurrently. One program involved the process development of synthesizing mixed plutonium-uranium carbide into high-density pellets. This fuel was to be used in the Advanced Fuel System Program for liquid metal fast breeder reactors. The second program "demonstrated the use of a molten salt oxidizer to reduce the volume of transuranic solid waste." According to the 1992 summary, these programs resulted in facility modifications to meet new environmental standards, new safeguard requirements, and new licensing and radioactive materials facility operation standards of safety. These modifications resulted in changes to the glove box lines and piping and ventilation systems.[3]

Based on historical documents, the major effort at Building 4055 involved plutonium-bearing fuels, primarily plutonium-239. The final products from these operations were solid reactor fuel materials, radioisotope heat sources, or radiation sources in a "variety" of forms and compositions. These, according to a 1967 radiation and nuclear safety document, included Po-

[1] Atomics International, *License Application for the Nuclear Materials Development Facility*, June 24, 1966.
[2] Litwin, R.Z., Rockwell International Letter Re: RI Background and Capability to Develop a Weapons-Grade Plutonium Fuel Cycle and Disposal Evaluation for the PDR, October 5, 1992.
[3] Litwin, R.Z., Rockwell International Letter Re: RI Background and Capability to Develop a Weapons-Grade Plutonium Fuel Cycle and Disposal Evaluation for the PDR, October 5, 1992.

210, Pu-238, Pu-239, and Cm-242. For "feed material," any of the programs used various forms of plutonium, uranium, and "other radionuclides." Operations involving encapsulated radiotoxic materials were performed in the above, described glove boxes. The building also served as an analytical chemistry support facility for the Fast Flux Test Facility from 1968 to 1969, as indicated above. Operations also included research for uranium-plutonium scrap pellet recycling programs, and fission research on microscopic dispersion of tungsten in uranium plutonium fuel.[1, 2,3,4]

The 1981 onsite radiological contingency plan indicated that research development programs were conducted to investigate preparation methods for fast reactor and radionuclide fuels including mixed carbides, oxides, nitrides, sulfides, silicides, and various radionuclides. The objective of the building laboratory was to "develop appropriate equipment and quality measures… that are adaptable to full-scale, fuel-element, and radioisotope-source fabrication."[5]

According to a 1984 application for the renewal of the special nuclear material license, the following procedure was employed at Building 4055 for the receipt and handling of plutonium:[6]

> A typical process involves the receipt of the Pu-238, in the form of an oxide at Building 4055… in DOT-approved shipping containers. It would be stored in the building vault in lots no larger than 2.5 kg of contained Pu-238, in the fixed locations established for Pu-239.
>
> As the plutonium is acquired, it would be transferred into a glove-box line at the facility and the final inner container removed. A typical fuel form would be microspheres or hollow cylindrical cermets. In a typical process sequence, the material would be weighed, placed into the primary encapsulation, and sealed by welding. The capsule would be leak-checked, decontaminated, and removed from the glove-box train. The capsule would then be transported to an electron-beam welder for subsequent secondary encapsulation and leak checks. After the integrity of the capsule was confirmed, it would be packaged in an approved storage container and stored pending shipment. The maximum batch size of Pu-238 in a glove box is 2.5 kg in the oxide form.

The contingency plan also indicated that the procedures for handling analytical chemistry samples of plutonium-bearing fuel, and other highly toxic material samples, varied according to the size of the sample and the nature of the analysis being performed. The gross sampling and weighing was performed in standard glove boxes designed for that purpose. Dissolution of the bulk samples and any analysis requiring significant quantities of toxic materials, including carbon analysis, oxygen analysis, and spectrographic analysis, was performed within glove boxes as well. For analytical procedures that required small material quantities less than 1 milligram, aliquots of solutions were prepared in the glove boxes, placed in suitable sealed containers,

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[1] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[2] Oak Ridge Associated Universities Report, no document number, *Confirmatory Radiological Survey Nuclear Materials Development Facility (Building T-055), Rockwell International, Santa Susana, California*, July 1987.
[3] Rockwell International, ESG-81-30, *Onsite Radiological Contingency Plan for Rockwell International Operations Licensed Under Special Nuclear Material License No. SNM-21*, August 28, 1981.
[4] Atomics International, AI-67-3, *Radiation and Nuclear Safety at Atomics International*, March 1, 1967.
[5] Rockwell International, ESG-81-30, *Onsite Radiological Contingency Plan for Rockwell International Operations Licensed Under Special Nuclear Material License No. SNM-21*, August 28, 1981.
[6] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.

tagged out, and transferred to one of the two fume hoods located in the Chemical Support Laboratory. The samples were opened in the fume hoods for whatever experiment or analysis being performed. Samples were also prepared in the fume hoods for analyses requiring counting techniques prior to being transferred to the counting room in suitable containers.[1]

For seven months in 1970 Building 4055 fabricated mixed uranium-plutonium oxide pellets for irradiation tests for Argonne National Laboratory. This effort produced mixed uranium-plutonium oxide pellets that were used by Argonne National Laboratory for irradiation tests. These operations lasted through September 1970, at which time the facility was put on standby maintenance and surveillance mode. The NMDF was in standby from September 1970 until March 1974 when the NMDF was activated to participate in the Advanced Fuel Systems Program for liquid metal fast breeder reactors. Concurrently, from 1974 to 1975, Building 4055 was also upgraded and outfitted for the AIR-I fuel pin program, which demonstrated the use of a molten salt combustor at Glove Box 11 to reduce the volume of transuranic (TRU) solid waste.[2,3] [redacted][4,5]

[redacted]

[1] Rockwell International, ESG-81-30, *Onsite Radiological Contingency Plan for Rockwell International Operations Licensed Under Special Nuclear Material License No. SNM-21*, August 28, 1981.
[2] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[3] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[4] Grantham, L.F., Rockwell International Internal Letter Re: Application to Use Plutonium in Radwaste Combustion Tests, January 21, 1975.
[5] Atomics International, Document No. TI-001-630-001, *Safety Review Committee Action on Glvoe-Box Operation Safety Evaluation for Radwaste Combustor in Bldg T055*, January 30, 1975.

As indicated above, in addition to the Advanced Fuel Systems Program, Building 4055 was also involved in the AIR-I fuel pin program. Development of the process to reduce the volume and weight of TRU waste began in 1974 when bench-scale combustion tests on uncontaminated waste were carried out. Following the uncontaminated waste tests, combustion tests of plutonium-contaminated waste in a bench-scale combustion unit were performed in Building 4055. According to the final decommissioning report, a total of three molten salt combustion tests were completed using the bench-scale equipment setup.[1]

As indicated above, Atomics International participated in the Advanced Fuels System Program under contract with the AEC. The initial phase of the program included process development in the synthesis of mixed plutonium-uranium carbides and nitrides, and the fabrication of these materials into high density fuel pellets. The maximum inventory of plutonium in Building 4055 during the first phase of operation was limited to 350 grams. According to a 1974 special nuclear material control report, typical batches of powder and pellets contained approximately 16 to 20 grams of plutonium. Upon receipt of radioactive material to Building 4055, the shipping containers of PuO_2 were transferred to the hoods in the Chemistry Laboratory where they were unpacked down to the primary containment vessel. Following a series of procedures to weigh the material and place it into storage containers, the containers are stored in the Nuclear Material Storage Vault, Room 131. Uranium dioxide was received and treated similarly.[2]

All operations for the research and development program were reported to have taken place in the interconnected glove box processing line. According to a 1975 environmental impact statement the highly enriched and depleted UO_2, PuO_2, and graphite was converted to fuel pins containing mixed uranium plutonium carbides. Following processing, all containers used, including crucibles, were to be cleaned in-line to the extent possible to recover any special nuclear materials. The items were then collected and measured "to determine [special nuclear material] content for each inventory and/or prior to disposal as non-recoverable waste unless a determination [was] made by other means that the item contain[ed] less than 10 grams Pu."[3,4]

On December 22, 1975, Rockwell International requested approval of planned physical security of materials generated in Building 4055. According to the letter, the fuel pin generated from the production above was approximately 40 inches long with an active fuel length of approximately 13.5 inches. Each fuel pin contained a nominal 116 grams of U-235 and 41 grams of plutonium for a total of 157 grams of fissionable material. Following the final closure weld, the pins were cleaned and subjected to centrifugal bonding and x-ray processes. According to Rockwell International, it was necessary to locate the centrifugal bonding machine in Building 4100 and the X-ray machine in Building 4172. As a result, it became necessary to remove the pins from the protected areas of Building 4055 and transport them, two at a time, to Buildings 4100 and 4172. The letter indicated that these operations were to begin in late February 1976 and

[1] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[2] Atomics International, AI-74-44, *Special Nuclear Material Control Program for Plutonium Use by Atomics International Division of Rockwell International in Research and Development Activities Under Special Nuclear Material License No. SNM-21*, May 24, 1974.
[3] Atomics International, AI-74-44, *Special Nuclear Material Control Program for Plutonium Use by Atomics International Division of Rockwell International in Research and Development Activities Under Special Nuclear Material License No. SNM-21*, May 24, 1974.
[4] Rockwell International, AI-76-21, *Environmental Impact Assessment of Operations at Atomics International Under Special Nuclear Materials License No. SNM-21*, April 30, 1976.

requested approval prior to then.[1] Information regarding the approval of these operations could not be located in available documents.

In 1975, the facility was upgraded to address new environmental, safeguard, licensing and radioactive materials facility operating standards. In May 1977, the reactor research division notified Atomics International to close out the Mixed Carbide Fuel Fabrication Program. Some funding was provided at this time to keep the facility operational and to perform some decommissioning work on excess glove boxes. According to the final decommissioning report, carbide fuel was oxidized at this time and four glove boxes were cleaned to non-TRU levels by a combination of foam cleaning and acid wash. The glove boxes were packaged and shipped for land burial, although the report does not provide information to indicate where the glove boxes were buried.[2,3] It was also reported in a 1977 annual review of radiological controls that all plutonium was removed from Building 4055 in the spring of 1978, and a program using depleted uranium, as uranium carbide, was initiated.[4] The review did not indicate how or where the plutonium was transported to.

In November 1978, Atomics International received funding to fabricate depleted uranium-carbide blanket pellets for Combustion Engineering. Production began in June 1979 and ended in late 1979.[5] Specific information regarding this process could not be located.

Following the combustion engineering operations, decommissioning efforts began in late 1979 beginning with the decontamination of equipment and the treatment of the remaining uranium carbide on site. According to a 4th quarter report in 1981, uranium carbide "scrap" was being converted to an oxidized state, and Advanced Fuels System sodium-bonded fuel pins were being decladded.[6,7] The conversion of waste uranium carbide to the oxidized state was reported to have been completed during the first quarter of 1983.[8]
According to the final decommissioning report, Building 4055 contained radioactive structures, systems, components, concrete, and soil. A summary of contamination in the facility was presented in the final decommissioning report and is presented below:[9]

> **Support Area** – The Chemistry Laboratory in the support area had two HEPA-filtered hoods that were known to have fixed contamination. The Quality Assurance laboratory was used for waste package scanning and was suspected of low levels of contamination. Some alpha activity was released to the room when a plastic bag containing waste leaked. Detectable activity was cleaned at the time of the release.

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[1] Remley, M.E., Letter Re: Physical Security of Special Nuclear Materials Docket 70-25, December 22, 1975.
[2] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[3] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[4] Rockwell International, Document No. N001TI000098, *Annual Review of Radiological Controls – 1977*, May 27, 1980.
[5] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[6] Moore, J.D., Internal Letter Re: Quarterly Review of NMDF (T055) for Radiation Safety , Fourth Calendar Quarter, 1981, February 22, 1982.
[7] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[8] Moore, J.D., Internal Letter Re: Quarterly Review of NMDF (T055) for Radiation Safety – First Calendar Quarter, 1983, July 7, 1983.
[9] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.

Glove Box Room – All easily accessible surfaces of the glove box room were kept clean. However, some alpha activity was released to the room when a plastic bag covering a glove box port split as a result of over pressurization caused by a solenoid valve failure. All detectable activity was cleaned up during the decontamination effort that followed this incident. Another known source of contamination was from an oil leak from a vacuum pump that penetrated the floor covering. This resulted in a small portion of the concrete slab becoming contaminated.

Stainless Steel Materials Storage Vault – The vault had no known areas of contamination.

Radioactive Exhaust Filter Room – The filter room had no known areas of contamination, but contained the contaminated filter system for the glove box exhaust. The filter system for the glove box room also was in this room and was not known to be contaminated; however, because of the difficulty of demonstrating this by survey measurements, it was assigned a "contaminated" status.

Liquid Radioactive Waste Holdup System – This system had low-level contamination from evaporation of contaminated floor mop water that drained from the building into the system. The evaporation was caused by solar heating of the holdup tanks.

In addition, it was noted that contamination was also present inside the glove boxes, the transfer tunnels between glove boxes, the hoods in the controlled area, and the glove box exhaust system.[1] The decontamination plan noted that approximately 98 percent of all the plutonium contamination in Building 4055 was contained within the 38 glove boxes, and ranged from 100 to 10,000,000 dpm/100 cm^2 (removable, per smear paper swipes). The chemical fume hoods had removable smear contamination levels varying between 1,000 to 10,000 dpm/100 cm^2. The low-volume glove box exhaust system ducts were reported to have smear sample contamination levels ranging between 1,000 and 10,000 dpm/100 cm^2. And the high-volume air exhaust system ducts had suspected contamination levels of 0 to 100 dpm/100 cm^2, mostly alpha, from plutonium and its decay products. According to the plan, all areas that were normally accessible to operating personnel had measured contamination levels of less than 2 dpm/100 cm^2, alpha.[2]

The entire building was stripped to the walls, including contaminated equipment and surfaces, drain lines, and ventilation ducts. This material and the retention well were decontaminated, the equipment was disposed of as low-level waste, and the liquid waste and exhaust systems were removed.[3, 4,5] The final decommissioning report indicated that the facility was decontaminated to levels that were "as low as reasonably achievable" at the completion of the decommissioning and release for unrestricted use, and in all cases, below the levels specified in the table below.[6]

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1 Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
2 Rockwell International, Document No. AI-78-10, *Decontamination Plan for Atomics International Facilities Licensed Under Special Nuclear Material License SNM-21*, March 10, 1978.
3 Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
4 Oak Ridge Associated Universities Report, no document number, *Confirmatory Radiological Survey Nuclear Materials Development Facility (Building T-055), Rockwell International, Santa Susana, California*, July 1987.
5 Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
6 Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.

Building 4055
Rockwell International Acceptable Limits for Residual Radioactivity

	Total Average[a]	Total Maximum[b]	Removable
Surface contamination			
Beta-gamma emitters	5,000 dpm/100 cm^2	15,000 dpm/100 cm^2	1,000 dpm/100 cm^2
Alpha emitters	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Surface dose rate At 1 cm through 7-mg/ cm^2 absorber	0.1 mrad/hr	0.5 mrad/hr	
Ambient exposure rate At 1 m from surface	4 mR/hr		
Soil contamination Pu-239	25 pCi/gram[c]		
Water Released to unrestricted areas	<110% of local water supply		

[a] Average over a 1-square meter area
[b] Maximum value measured in 1-square meter area, averaged over 100 cm^2
[c] NRC requirement for Building 4055 only

Decontamination and deactivation of Building 4055 was initiated in October 1982 and was completed October 1986. Final surveys, waste shipments, and the final report were completed by March 1987. Decommissioning began with the decontamination and removal of glove boxes and connecting tunnels, including the glove box equipment. The tunnels were decontaminated and removed from the support system in sections that were approximately 5 feet in length. Both the tunnel sections and the glove boxes were packaged for disposal as low specific activity waste. According to the final decommissioning report, hand scrubbing, followed by strippable paint and paint removal, was found to be effective means for reducing contamination levels in the glove boxes and tunnel sections to under the upper limit for low specific activity waste. The upper limits for plutonium surface contamination at Building 4055 are presented in the table below. Some hot spots in the glove boxes required extra decontamination in the form of wet and dry abrasive materials. A flow diagram of the glove box cleaning operations is presented in Figure 2.2.4.m.[1,2]

Building 4055
Rockwell International Surface Contamination Limits for Plutonium

Area	Activity	Upper Limit	Action Limit
Un-posted areas and radiation areas	Total	100 dpm/100 cm^2	Detectable
	Removable	20 dpm/100 cm^2	Detectable
Contamination areas and airborne radioactive area	Total	2,500 dpm/100 cm^2	Detectable
	Removable	500 dpm/100 cm^2	Detectable
Restricted access areas	Total	Unspecified	Detectable
	Removable	Unspecified	Detectable

Personnel then removed utilities and the low-volume exhaust system. The support area was decontaminated and the NaK in the glove box atmosphere purifiers was disposed of. This was

[1] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[2] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.

followed by the removal of the liquid waste holdup system and the removal of the high-volume exhaust system. According to the final building survey report, the waste generated during cleanup operations was "packaged concurrent with the generating operation and shipped for disposal at the discretion of the [RMHF]."[1,2] Approved facilities included Rockwell Hanford Operations (RHO) for long-term storage of transuranic waste and the Nevada Test Site for the shallow-land burial of low specific activity waste.[3] A transuranic waste handling and packaging plan indicated that transuranic items were packaged into galvanized 55-gallon drums obtained from the RHO. According to the plan, sixty-nine transuranic drums from the Building 4055 decontamination effort were shipped to RHO during August 1984. Additional transuranic waste was packaged in mid-August 1984; however, these 34 55-gallon drum containers were put into storage due to lack of funding and approved shipping containers.[4] Rockwell International requested approval for the shipment of this waste from RHO on February 27, 1987. Rockwell International described the waste as follows:[5]

> . . . 29 are from the shutdown and decontamination of our plutonium R&D facility; four remain from the SEFOR fuel decladding program conducted at our hot laboratory; one contains a radium-beryllium neutron source from our L-85 research reactor and a few radium sources and gauges removed from old fire detection probes. . .
>
> The 29 drums from the plutonium facility include 27 drums of TRU wastes from decontamination of the building, one drum of mixed plutonium-oxide, uranium-oxide scrap from the advanced fuel programs, and one drum containing miscellaneous secondary NDA fuel measurement standards.

As of June 8, 1987, the waste remained at the SSFL in storage at the RMHF.[6]

Additional information regarding the decontamination effort at Building 4055 is provided from the final building survey report below:

> Decontamination of the glove box surfaces was accomplished utilizing ALARA [as low as reasonably achievable] strippable paint… Glove box and tunnel section removal was completed in November 1985. Survey of the decontaminated glove boxes was conducted to assure that there were no transuranic waste and were within the criteria of low specific activity waste.[7]

All components of the low-volume exhaust system, consisting of blowers, absolute filter banks, and associated valves and controls, were removed except for the stack which was still linked to the high-volume exhaust system. This was completed in February 1985. The utilities that were removed and "dispositioned" included those used specifically for glove box operations, including cooling water, argon, helium, dry air, vacuum, and electrical and control wiring. Also included were those utilities that serviced the glove box room, including compressed air, electrical power,

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[1] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[2] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[3] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[4] Rockwell International, Enclosure 2 to 87RC02380, *Rockwell Division, Rockwell International, Transuranic Waste Handling and Packaging Plan*, February 27, 1987.
[5] Remley, M.E., Rockwell International Letter Re: Disposal of Transuranic Waste, February 27, 1987.
[6] Remley, M.E., Rockwell International Letter Re: Plutonium-Contaminated Waste, June 8, 1987.
[7] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.

lighting, PA systems, phones, sprinklers, fire alarm circuits, radiation alarm systems, and intrusion alarms. Removal of the utilities servicing the glove box room was completed in November 1984.[1]

According to the final building survey report, all equipment and materials in the support areas were also surveyed and removed and disposed of according to the level of activity found. This material included furniture, sinks, light fixtures, and other office and laboratory equipment. Decontamination of the support areas was completed in October 1984. The report stated that some material from this area, with no detectable radioactivity, was disposed of as conventional waste.[2]

Disposal of the NaK in the glove box atmosphere purifiers and the NaK bubblers required the installation of a special NaK disposal facility at the building (see Figure 2.2.4n). This incorporated remnants of the facility utilities and liquid waste system. The NaK removal process involved a combination of evaporation of potassium and sodium at approximately 900 degrees Fahrenheit, steaming, and finally, a water rinse. Following cleaning, the NaK bubblers were surveyed to verify their classification as low specific activity waste and were transferred to the RMHF for packaging in 55-gallon drums and staging for shipment to a disposal site. The process water generated during the removal of NaK from the bubblers was neutralized, transferred to the RMHF, and evaporated. The residual solids were packaged and stage for shipment to a disposal site. These activities were completed in June 1986.[3,4]

The removal of the liquid waste system required the removal of all drain lines between the various sources, such as the laboratory sinks and shower drains, and the removal of the process and storage tanks and their associated equipment. According to the final decommissioning report, the removal of the liquid waste system also required the removal of all remaining liquid and sludge waste in the liquid waste retention system, and the removal of the four process and storage tanks and their associated equipment. All the components were packaged and disposed of. It was anticipated that the system was not anticipated to be highly contaminated, which, according to the decommissioning report, was verified by a survey of all the components. The excavation sites for the removal of the drains were surveyed and soil samples were taken. The report did not include the results of the surveys but reportedly indicated that an analysis of the soil samples verified that the soil was not contaminated. The removal of the liquid waste system was completed in May 1986.[5,6]

In August 1986, Rockwell completed the removal of the components of the high-volume exhaust system. Following all removal actions, the following waste volumes were generated during the decontamination and decommissioning for Building 4055.[7,8]

[1] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[2] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[3] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[4] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[5] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[6] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[7] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[8] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.

Building 4055
Waste Volumes Generated During Decommissioning

Waste Type	Quantity (Cubic Feet)
Low specific activity	10,410
Glove boxes	5,256
Tunnel sections	861
Transuranic	692

According to this survey report, Building 4055 was decontaminated and all radioactive materials were removed from the site. With the exception of the boiler located in Room 128, the emergency diesel generator located in Room 132, and the associated compressors and air conditioning units located outside of the building on concrete foundations, the building interior had been stripped to the walls.[1,2]
Limited information has been located to indicate the operations of the building from 1986 through the present. On October 7, 1987, Building 4055 was officially removed from the Nuclear Regulatory Commission Special Nuclear Material License No. SNM-21 and released for unrestricted use.[3] Monthly progress reports indicate that Building 4055 was included in a surveillance program and underwent continued deactivation. According to the October 1987 monthly progress report, the following TRU waste awaited shipment: 16 drums of dry TRU waste to be shipped to Westinghouse Hanford Company, and eleven drums of TRU contaminated oil to either Westinghouse Hanford Company or EG&G. The report also indicated that Building 4055 was planned to be used to support Rocketdyne's "Space Station and Advance Programs."[4] In December 1987, Rockwell International reported that arrangements were being made to ship the scrap uranium oxide from Building 4055 to the Nevada Test Site. The report did not indicate where this material was being stored prior to shipment.[5]

Based on a December 7, 1987, internal Rockwell International letter, the building required work to be made usable for advanced programs and the Space Station Program. According to the letter, the items that needed to be completed included the following:[6]

- Replace drain system
- Backfill trenches
- Repair pavement
- Repair fence
- Repair concrete floor
- Patch facility walls
- Paint
- Installation of fluorescent fixtures
- Install electrical conduit

[1] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.
[2] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[3] Rouse, Leland, NRC Letter Re: SNM-21, Amendment No. 1, October 7, 1987.
[4] Kellogg, L.G., Letter Re: Monthly Progress Report, October 1987, November 6, 1987.
[5] Dennison, W.F., Letter Re: Monthly Progress Report, December 1987, January 5, 1988.
[6] Schrag, F.C., Rockwell International Internal Letter Re: Estiamte for Rectification of NMDF, Building 055, December 7, 1987.

- Repair heating and air supply system
- Replace PA speakers
- Replace fire sprinkler system

In June 1988, Rockwell International reported that the fire sprinkler system would be replaced and the drums of TRU-contaminated oil would be shipped; however, a January 1989 progress report indicated that the shipment of the drums could not be achieved as a result of a "waste shipment moratorium" in the state of California and receiving of all wastes in the state of Idaho. Monthly reports in September and October 1988 also noted that the 11 drums of TRU-contaminated oil would be solidified and repackaged to conform to Edgerton, Germeshausen, and Grier (EG&G) Idaho, Inc.'s required criteria. This solidification occurred on October 3 through October 7, 1988, and consolidated nine drums of sludge and liquid into 3 drums using "Petroset." The remaining drums were also solidified, resulting in four drums of TRU-waste requiring disposal.[1,2,3,4,5]

In August 1989, the progress report indicated that in addition to maintenance and surveillance of Building 4055, Rockwell International was also responsible for performing repairs to the building from damage resulting from the decontamination and decommissioning operations. This included the repair of damaged wall sections, the paving of ditches, the replacement of floor tiles, and the replacement of five sprinkler systems that has been removed.[6]

As of the March 1990 progress report, the four 55-gallon drums of TRU waste were to be shipped to the Idaho National Engineering Laboratory; however, shipment continued to remain on hold pending a resolution of disposal issues with the state of Idaho. According to the report, the material was in storage on site at the RMHF.[7] Available documents do not provide information to indicate when the material was finally shipped; however, as of April 1994, the waste remained at the SSFL.[8]

On May 23, 1991, Rockwell International submitted a letter to the Ventura County Air Pollution Control District regarding the activation of Building 4055 in support of new lasers and advanced technology research programs, including diamond coating technology. The letter indicated that the programs were operated out of the Vanowen Building at Canoga Park but were being relocated to Building 4055. Upgrades required to the building included: "insulation of building, HVAC, fire protection and electrical." Rockwell International indicated that hydrogen gas, argon gas, and methane gas would be stored outside the building and piped in for use in the building. There were also a number of chemicals that were proposed for use in bench scale experiments and that would be housed in chemical storage cabinets in the laboratory. The chemicals listed included acetone, IPA, and methanol; H2SO4, HF, HCl, and H2O2 and HNO3.

1 Dennison, W.F., Letter Re: Monthly Progress Report, June 1988, July 8, 1988.
2 Dennison, W.F., Letter Re: Monthly Progress Report, September 1988, October 6, 1988.
3 Dennison, W.F., Letter Re: Monthly Progress Report, October 1988, November 7, 1988.
4 Dennison, W.F., Letter Re: Monthly Progress Report, January 1989, February 8, 1989.
5 Moss, T.A., Letter Re: Monthly Progress Report, April 1989, May 15, 1989.
6 Moss, T.A., Letter Re: Monthly Progress Report, August 1989, September 15, 1989.
7 Moss, T.A., Letter Re: Monthly Progress Report, March 1990, April 12, 1990.
8 Kearns, Roy, Memorandum Re: Validation of Rocketdyne Transuranic Waste Data, April 18, 1994.

The acetone and alcohols were to be used to clean laser optics and the acids were to be used in the diamond coating studies.[1]

A September 1991 internal letter provided a listing of chemicals that were planned for use in Building 4055 and were to be stored in the clean room and high bay of the building. The table below provides a listing of the chemicals used and stored in Building 4055.[2]

1991 Chemicals for Building 4055

Chemical Name	Description	Yearly Use	Location
Hydrochloric Acid	Acid	3 gallons	Clean room
Catechol (Pyrocatechin)	Buffer	3 gallons	High bay
Potassium Hydroxide Solution	Base	5 gallons	High bay
Nitric Acid	Acid	10 gallons	Clean room
Hydrofluoric Acid	Acid	10 gallons	Clean room
Hydrogen Peroxide 50%	Oxidizer	3 gallons	Clean room
Ethylenediamine Anhydrous	Base	4 gallons	High bay
Sulfuric Acid	Acid	10 gallons	Clean room
Ethanol	Solvent	3 gallons	Clean room
Acetone	Solvent	5 gallons	High bay
Methanol	Solvent	5 gallons	Clean room
Trichloroethane -TCA	Solvent	3 gallons	High bay
Acetic Acid	Acid	3 gallons	Clean room

A March 16, 1992, Rockwell International letter to the Ventura County Air Pollution Control District indicated that Building 4055 was under the final phase of activation. The final phase included the reconfiguration of the northern third of the building that included the reconstruction of the existing hard-wall offices into six hard-wall laboratories. The construction included wall relocations, new suspended ceilings, lighting, sprinkler system reconfiguration, and air conditioner re-ducting. The letter also indicated that concrete foundations would be added on the east side of the building for the installation of a 20,000 solid cubic feet N_2 gas bottle farm, a 20,000 solid cubic feet Argon gas bottle farm, six H_2 K-bottles, one CH_4 K-bottle, and one O_2 K-bottle. These gases were to be plumbed to the various laboratories.[3] The letter did not indicate the operations to be conducted in Building 4055.

On August 4, 1992, Authorization Number 157 was issued to Rockwell International to assemble and test a 350 kV klystron in Building 4055 in conjunction with the development of a prototype Ground Based Free Electron Laser (GBFEL). The laser program involved the fabrication of a free electron laser and testing the laser to avoid the generation of neutrons by electron interaction with laser materials. The use authorization was set to expire on August 4, 1993. The authorization indicated that the authorized use of the klystron was to be located in a high bay and annex of Building 4055. Based on a review of available documents, the use authorization was not renewed or cancelled.[41]

[1] Melvold, R.W., Letter Re: Activation of Building 055 in Area IV, SSFL to be used as a Research and Development Lab, May 23, 1991.
[2] Jackson, K., Rockwell International Internal Letter Re: Chemicals for Building 055, September 18, 1991
[3] Melvold, R.W., Letter Re: Building 055 Activation, Final Phase, March 16, 1992.
[4] Barnes, J.G., Authorization for Use of Radiological Materials or Radiation Producing Devices, Authorization No. 157, August 4, 1992.

Based on information obtained from Boeing, the building is currently occupied and is operated for non-radiological laser research. Building operations, as of February 2011, were in the process of being ceased and were to have stopped completely by May 2011.

Information from Interviewee: Interviewee 267 had extensive knowledge on the processing and handling of fuel at Building 55. The following are excerpts from that interview:

> *"I worked in Building 55 where plutonium was processed for fuel for field program processes in Idaho as well as for the SRE. I initially helped define the processes and handling. 13 men worked in Building 55, and we all worked rotating shifts. It was AEC-contract work. We used glove boxes to handle the plutonium, which were in the form of fuel pellets. The pellets were nickel plated through the application of nickel carbonyl. The radiological material was also handled with manipulators. This was also known as Building 2345, (because it had Divisions 2, 3, 4 and 5 within), and was Top Secret. Everything that left the building had a red tag indicating Top Secret. As far as I know, I am the last living person who worked on the production line in Building 55."*
>
> *"Building 55 generated low level radioactive waste that was shipped off site for disposal in small boxes. I remember someone putting too much waste in a container, which went critical. I don't remember how it was mitigated."*
>
> *"Across the street from Building 55 was Building 20, which was used for stripping and decladding used fuel rods that came offsite from different contractors. There was also Building 231 nearby which decladded fuel as well. Casts were also prepared there to transfer radiological materials."*
>
> *The difference in Buildings 20 and 231 was that 231 handled AI materials only."*

Radiological Incident Reports: There have been several incidents associated with Building 4055 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 the incident reports that resulted or may have resulted in releases to the environment are provided following the table, when available.

Building 4055 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0286	5/9/1970	Glove Box Room	Pu	Hole in Pu glove box glove contaminated employee
A0222	6/26/1973	Glove Box Room	Pu	Glove box controller failure pressurized box releasing contamination to area
A0224	12/21/1977	Glove Box Room	Pu	Contaminated roll of green tape discovered in glove box room
A0063	1/10/1978	Glove Box 26	Pu	Employee contaminated during foam cleaning of glove box

[1] Dix, T.E., Rockwell International Internal Letter Re: Minutes of Radiation Safety Committee Meeting with Free Electron Laser Project Concerning Use Authorization Request, March 2, 1992.

Building 4055 Incident Report Summary (continued)

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0068*	5/4/1978	Glove box Room	Pu	Leaking glove contaminated employee lab coat and surgeon gloves
A0335	5/10/1978	Glove box Room	Pu	Lost seal during change out caused loss of vacuum and contamination
A0071	6/15/1978	Glove box Room	Pu	RADIOACTIVE Waste Compacted in “Suspect” Waste Compactor
A0225	6/30/1975	Stack Monitor	Pu	Stack Monitor Vacuum Line Disconnected in Plutonium Facility
A0072	7/16/1978	Facility		Failure of Air Sampling Pump and Backup Pump Shut Down Operations
A0226	7/21/1978	Stack Monitor	Pu	Stack Monitor in Plutonium Facility Out of Service 84 Hours
A0073	7/24/1978	Support Lab	Pu	Floor Contamination Found in Waste Handling Area
A0582	6/26/1979	B-55 Glove Box	Pu Am	Maintenance of Glove Box Furnace Caused Airborne Activity
A0081	5/10/1980	Stack Monitor	Pu	Failure of Stack Monitor System in Plutonium Facility
A0250	10/31/1980	Support Lab		Contaminated Green Coveralls Returned with Deconed “Blueline” Coveralls
A0085	5/31/1981	Stack Monitor	Pu	Failure of Stack Monitor System in Plutonium Facility
A0091	11/7/1981	Glove Box Room		False Airborne Alarm in Glove Box Room at Plutonium Facility
A0100	3/24/1982	Compactor Area	Pu	Waste Package with Glass Broke Cutting Hand of Employee
A0113	2/7/1983	Glove Box Room	Pu	Plutonium Oxide Incised Into the Left Index Finger of an Employee
A0114	3/27/1983	Stack Monitor		Response to Stack Monitor Alarm
A0164	8/29/1986	Outside		Overfilled Portable Radioactive Liquid Tank

*The incident report file was reported by Boeing to be missing.

Incidents of known environmental releases:

- On January 4, 1971, a water line to the air-conditioning unit in the attic of Building 4055 leaked, causing water to run into the office areas, change room, support area, and glove box room. Maintenance personnel attempted to pick up the water that had leaked with a vacuum cleaner. According to the internal letter documenting the incident, the radioactive waste system sump tank and the sample tank were both full, causing the water to back up in the support area drains. Personnel opened the valves to the 1,000-gallon holdup tank, which cleared the backed up water condition. According to the ltter, a total of 800 gallons was collected. The water was sampled and measured to be 2.8×10^{-9} μC/cc. The letter indicated that the “water was released to the Rocketdyne pond.”[1]

[1] Lane, W.D., North American Rockwell Internal Letter Re: Water Leak at the NMDF, January 14, 1971.

- A December 8, 1976, Rockwell International internal letter documented the release of radioactive sludge during the replacement of the radioactive waste line to the Building 4055 hold up tanks. According to the letter, removal of the old radioactive waste line was started by a contractor on December 6, 1976. The waste line was broken open where it exits Building 4055 and four smears were taken inside the pipe. The smears measured 0 dpm and the contractor was allowed to break out the remainder of the waste line. Approximately 2 hours after the initial start of work, water and sludge was observed running out of the line. Two sludge samples were taken and measured 15 and 53 dpm. Direct readings from inside the removed pipe read 700 dpm.
  Rockwell International surveyed the contractor personnel and instructed the contractor to cease work. Rockwell International staff removed the pipe and dirt where the sludge had run out of the pipes on December 7, 1976. Contaminated materials were put in "burial boxes" for disposal. A survey of the trench on December 7, 1976, indicated that no contamination was detected; however, the internal letter did not provide the results of the survey. The contractor was informed that the trench was released and was allowed to resume work.[1]

- On June 30, 1978, it was discovered that a stack monitor vacuum line had not been monitored for 23 days. Air samples taken directly from the room where the stack monitor was located were about twice the normal activity of the filtered air; however the incident report did not indicate what these levels were (A0225).[2]

- On July 21, 1978, it was discovered that a stack monitor in the plutonium facility was out of service for 84 hours due to an electrical failure. The incident report stated that airflow through a filter was maintained and no uncontrolled release of material occurred (A0226).[3]

- On March 27, 1983, Protective Services Control Center notified the facility health physicist of a stack monitor alarm. Upon investigation, the stack monitor chart showed an increasing count trend for about 1 hour to 26 dpm. The filter was removed and counted for alpha radioactivity. The result was 7 dpm alpha immediate and 3 dpm alpha after 19-hours of decay. After 72-hour decay, the final count on the stack sample was 0 dpm for a 100-minute counting time. The event was attributed to "the effect of atmospheric inversion conditions on naturally occurring airborne radioactivity." The alarm was reset and remained at normal levels. The incident report did not indicate whether the filter was reinstalled in the stack or if it was replaced with a new filter and disposed of (A0114).[4,5]

- On August 29, 1986, an unknown amount of water overflowed from the RMHF transfer tank onto asphalt at Building 4055. A summary of the incident was reported to have been included on an attached flysheet; however, the flysheet was not attached to the file

[1] Bradbury, S.M., Rockwell International Internal Letter Re: Replacement of R/A Waste Line to Hold-up Tanks at Bldg. 055, December 8, 1976.
[2] Owens, D.E., Internal Letter Re: Incident Report, July 26, 1978.
[3] Owens, D.E., Internal Letter Re: Stack Monitor Failure at NMDF, August 1, 1978.
[4] Moore, J.D., Internal Letter Re: Quarterly Review of NMDF (T055) for Radiation Safety – First Calendar Quarter, 1983, July 7, 1983.
[5] Bradbury, S.M., Internal Letter Re: Radiological Safety Incident Report, March 29, 1983.

obtained by the research team. As a result, additional information regarding this incident, including the location, cannot be provided at this time. Additional information may become available upon receipt of additional documents from Boeing's 1.4 million document database.[1]

Current Use: As of May 2005, Building 4055 was being used for non-radiological research; however, information regarding these operations has not been located.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): According to the 1973 annual report for environmental and radioactive effluent monitoring, the gaseous effluent released to unrestricted areas was monitored at Building 4055. Monitoring included the volume of the effluent releases, the average and maximum concentration (µCi/mL), and the total activity released (Ci). The results of this yearly data are presented in the annual environmental monitoring and facility effluent reports from 1973 through 1986.[2,3,4,5,6,7,8,9,10,11]

In addition, a soil sampling station (S-57) was located at Building 4055 at J Street, which was tested for soil plutonium radioactivity. A summary of the available survey results of the soil plutonium radioactivity data is presented in the table below: [12,13,14,15,16,17,18,1,2,3,4]

[1] Begley, F.E., Internal Letter Re: Radiological Safety Incident Report, October 21, 1986.
[2] Moore, J.D., *Environmental and Radioactive Effluent Monitoring Annual Report 1973*, Undated.
[3] Rockwell International, Report No. ESG-79-7, *Environmental Monitoring and Facility Effluent Annual Report 1978*, April 1979.
[4] Rockwell International, Report No. ESG-81-17, *Environmental Monitoring and Facility Effluent Annual Report 1980*, May 27, 1981.
[5] Rockwell International, Report No. ESG-82-21, *Environmental Monitoring and Facility Effluent Annual Report 1981*, July 15, 1982.
[6] Rockwell International, Report No. ESG-83-17, *Environmental Monitoring and Facility Effluent Annual Report 1982*, June 1983.
[7] Rockwell International, Report No. ESG-84-9, *Environmental Monitoring and Facility Effluent Annual Report 1983*, March 1984.
[8] Rockwell International, Report No. RI/RD85-123, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1984*, March 1985.
[9] Rockwell International, Report No. ESG-84-9, *Environmental Monitoring and Facility Effluent Annual Report 1983*, March 1984.
[10] Rockwell International, Report No. RI/RD85-123, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1984*, March 1985.
[11] Rockwell International, Report No. RI/RD86-140, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1985*,April 1986.
[12] Rockwell International, Report No. ESG-79-7, *Environmental Monitoring and Facility Effluent Annual Report 1978*, April 1979.
[13] Rockwell International, Report No. ESG-81-17, *Environmental Monitoring and Facility Effluent Annual Report 1980*, May 27, 1981.
[14] Rockwell International, Report No. ESG-82-21, *Environmental Monitoring and Facility Effluent Annual Report 1981*, July 15, 1982.
[15] Rockwell International, Report No. ESG-83-17, *Environmental Monitoring and Facility Effluent Annual Report 1982*, June 1983.
[16] Rockwell International, Report No. ESG-84-9, *Environmental Monitoring and Facility Effluent Annual Report 1983*, March 1984.
[17] Rockwell International, Report No. RI/RD85-123, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1984*, March 1985.
[18] Rockwell International, Report No. RI/RD86-140, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1985*,April 1986.

S-57 (Building 4055) Soil Plutonium Radioactivity Data

Date	Pu-238	Pu-239 + Pu-240
June 8, 1978	$(-2.13 \pm 2.2) \times 10^{-9}$ µCi/g	$(1.04 \pm 2.3) \times 10^{-9}$ µCi/g
December 13, 1978	*	$(6.21 \pm 3.5) \times 10^{-9}$ µCi/g
July 9, 1980	$(1.4 \pm 3.4) \times 10^{-9}$ µCi/g	$(9.5 \pm 4.8) \times 10^{-9}$ µCi/g
December 22, 1980	$(-0.3 \pm 2.3) \times 10^{-9}$ µCi/g	$(5.6 \pm 3.2) \times 10^{-9}$ µCi/g
July 8, 1981	$(-3.7 \pm 1.4) \times 10^{-9}$ µCi/g	$(0.04 \pm 1.7) \times 10^{-9}$ µCi/g
December 17, 1981	$(-3.4 \pm 1.5) \times 10^{-9}$ µCi/g	$(4.8 \pm 3.1) \times 10^{-9}$ µCi/g
July 9, 1982	$(1.0 \pm 0.4) \times 10^{-9}$ µCi/g	$(3.9 \pm 0.6) \times 10^{-9}$ µCi/g
December 16, 1982	$(-8.0 \pm 1.5) \times 10^{-9}$ µCi/g	$(5.1 \pm 2.2) \times 10^{-9}$ µCi/g
June 22, 1983	$(1.4 \pm 1.9) \times 10^{-9}$ µCi/g	$(2.4 \pm 2.4) \times 10^{-9}$ µCi/g
December 7, 1983	$(0.3 \pm 0.6) \times 10^{-9}$ µCi/g	$(3.8 \pm 2.2) \times 10^{-9}$ µCi/g
June 25, 1984	$(0.1 \pm 0.1) \times 10^{-9}$ µCi/g	$(5.2 \pm 0.7) \times 10^{-9}$ µCi/g
December 4, 1984	$(0.4 \pm 0.1) \times 10^{-9}$ µCi/g	$(2.2 \pm 0.4) \times 10^{-9}$ µCi/g
June 26, 1985	0 ± 0.0001 pCi/g	0.0038 ± 0.0004 pCi/g
December 4, 1985	0.003 ± 0.0003 pCi/g	0.0028 ± 0.0005 pCi/g
June 25, 1986	0.0004 ± 0.0003 pCi/g	0.0005 ± 0.0003 pCi/g
December 8, 1986	0.0003 ± 0.0002 pCi/g	0.0010 ± 0.0004 pCi/g
June 22, 1987	0.0001 ± 0.0001 pCi/g	0.0012 ± 0.0003 pCi/g
December 7, 1987	0.0006 ± 0.0002 pCi/g	0.0031 ± 0.0004 pCi/g
June 29, 1988	0 ± 0.0001 pCi/g	0.0039 ± 0.0005 pCi/g
December 1, 1988	0 ± 0.0001 pCi/g	0.0032 ± 0.0005 pCi/g
July 19, 1989	0.0004 ± 0.0001 pCi/g	0.0049 ± 0.0005 pCi/g
December 5, 1989	0.0002 ± 0.0002 pCi/g	0.0054 ± 0.0006 pCi/g

Note: The above data appears to be below reasonable detection limits at the time.
Minus (-) indicates sample value less than reagent blank.
*Results significantly less than the minimum detection level.

A chronology of all remaining available radiological investigations at this building is as follows:

- **1976 Rockwell International Soil, Water, and Sediment Sampling.** On December 14, 1976, Rockwell International collected "several" soil samples at seven on-site locations near Building 4055, and five soil samples at off-site locations of varying distances ranging from approximately 3 to 9 miles from the building. The samples were analyzed for Pu-238 and for total Pu-239 plus Pu-240 by the Health Services Laboratory of ERDA, Idaho Falls, Idaho. The sampling results included data for soil, water, and sediments samples. Soil samples ranged in distance from 50 feet northwest of the Building 4055 exhaust stack at the northwest corner of G and 24th Streets (Pu-238 = $-0.03 \pm 0.05 \times 10^{-8}$ µCi/g and Pu-239 plus Pu-240 = $-0.01 \pm 0.06 \times 10^{-8}$ µCi/g) to approximately 2,000 feet southeast of the Building 4055 exhaust stack at the southeast head of Bell Canyon at the

[1] Rockwell International, Report No. RI/RD87-133, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1986*, March 1987.
[2] Rockwell International, Report No. RI/RD88-144, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1987*, March 1988.
[3] Rockwell International, Report No. RI/RD89-139, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1988*, May 1989.
[4] Rockwell International, Report No. RI/RD90-132, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1989*, May 1990.

Area II pond (Pu-238 = 0.18±0.09 x 10^{-8} µCi/g and Pu-239 plus Pu-240 = 1.0±0.2 x 10^{-8} µCi/g).[1]

Water samples were taken at the west end of the surface drainage ditch in the ditch approximately 150 feet east of Building 4055 (Pu-238 = 0.0±0.8 x 10^{-11} µCi/g and Pu-239 plus Pu-240 = 0.0±0.6 x 10^{-11} µCi/g) and the north side of the Area II pond at the head of Bell Canyon approximately 2,000 feet from Building 4055 (Pu-238 = 0.0±0.7 x 10^{-11} µCi/g and Pu-239 plus Pu-240 = 0.3±0.7 x 10^{-11} µCi/g).[2]

Sediment samples were also taken at the west end of the surface drainage ditch in the ditch approximately 150 feet east of Building 4055 (Pu-238 = 1.4±0.2 x 10^{-8} µCi/g and Pu-239 plus Pu-240 = 12.8±0.6 x 10^{-8} µCi/g) and the north side of the Area II pond at the head of Bell Canyon approximately 2,000 feet from Building 4055 (Pu-238 = 0.05±0.07 x 10^{-8} µCi/g and Pu-239 plus Pu-240 = 0.03±0.06 x 10^{-8} µCi/g).[3]

- **1986 Rockwell International Soil Survey around Drain Lines.** The 2005 HSA reported results of a 1986 survey of soil surrounding drain lines. The research team has not yet received this survey report, and, as a result, the information provided is summarized from the 2005 HSA. In 1986, Rockwell International performed a survey of the Building 4055 drain lines to determine if any plutonium was left in the soil following removal. The survey concluded that soil from the drain line excavation was below the 1986 acceptable levels identified above; however, some soil samples showed detectable contamination. The maximum measurements were 0.613 pCi/g of Pu-239 and Pu-240 and 0.0421 pCi/g of Pu-238. The 1986 acceptance limit was 25 pCi/g. The NRC took confirmatory soil samples that supported the Rockwell samples.[4]

- **1986 Rockwell International Soil Survey around Drain Lines.** In 1986, Rockwell International also performed a survey of the Building 4055 interior building drain lines to determine if any plutonium was left in the soil following removal. Three soil samples were taken and analyzed for plutonium by liquid scintillation alpha counting. According to the report, the soil samples were taken as a result of the possibility of leaks in the pipes under the building while the building was in operation and as a result of possible leakage during the removal of the pipes. The drain lines had served as drain lines from the sinks, showers, and floor drains in the laboratory support area of Building 4055. The report indicated that significantly contaminated water was not allowed into these drains, but the drains were used for water that may have contained small concentrations of plutonium. The survey concluded that soil from the drain line excavation was below the 1986 acceptable levels of 10 pCi/g; however, some soil samples showed detectable

[1] Moore, J.D., Document No. AI-77-14, *Atomics International Environmental Monitoring and Facility Effluent Annual Report 1976*, Date Unknown.
[2] Moore, J.D., Document No. AI-77-14, *Atomics International Environmental Monitoring and Facility Effluent Annual Report 1976*, Date Unknown.
[3] Moore, J.D., Document No. AI-77-14, *Atomics International Environmental Monitoring and Facility Effluent Annual Report 1976*, Date Unknown.
[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. Citing Rockwell International Report, N704SRR9900124, *Plutonium Concentrations in Soil around Drain Lines at NMDF*, April 3, 1986.

contamination. The upper limit values for plutonium in soil samples from the three sampling locations ranged from 0.07 pCi/g to 0.216 pCi/g.[1]

- **1986 Rockwell International Final Radiation Survey.** Rockwell International also performed a final radiation survey in 1986 to determine the effectiveness of the decontamination effort and to demonstrate that the facility met release criteria for unrestricted use. The following criteria were used by Rockwell to demonstrate that the residual contamination was below acceptable limits:[2]

1986 Building 4055 Release Limits Criteria

Criteria	Alpha (dpm/100 cm^2)	Beta (dpm/100 cm^2)*
Total, averaged over 1 m^2	100	10,000
Total, maximum over 100 cm^2	300	30,000
Removable over 100 cm^2	20	2,000

*According to the final survey report, the acceptable beta contamination limits were derived from alpha contamination limits presented in Annex B of USNRC License SNM-21 for U-nat, U-235, U-238, and associated decay products. The beta values are twice those of the alpha limits reported based on the two beta particles emitted from the decay of Th-234, the first daughter of U-234, and Pa-234. The alpha limits correspond with the license annex limits for transuranics.

The survey divided the building into three sampling areas comprising the office area and Rooms 128, 132, 133, and the air conditioning room (office area and other unposted areas); the glove box room; and Rooms 117, 118, 119, 120, 121, 122, 123, 124, 126, 129, and 130 (posted areas). Each sampling area was overlain with a 3-square meter grid that was superimposed on the wall, floor, and ceiling of each room. Within each 3-square meter grid, a single 1 square meter was surveyed for 5 minutes and a 100 cm^2 area was smeared for removable contamination. Personnel measured for the average alpha surface activity, the average beta surface activity, the removable alpha surface activity, and the removable beta surface activity.

The maximum removable alpha and beta detected in the 141 samples taken from the office area and other unposted areas measured 4 and 34 dpm/100 cm^2, respectively. The maximum removable alpha and beta from 202 samples in the glove box room measured 11 and 36 dpm/100 cm^2, respectively. And the maximum removable alpha and beta from 201 samples in the posted areas measured 15 and 28 dpm/100 cm^2, respectively. The final report survey results detected hot spots in posted areas of the building. The maximum beta measurement in nine sampling locations in the posted areas was 41,664 dpm/100 cm^2. The maximum alpha measurement in 11 sampling location in the same areas was 10,465 dpm/100 cm^2. According to Rocketdyne the report, “in all cases where contamination was detected to be 80% of the acceptable limit, the area was decontaminated to activity levels below the instrument detection limit.”

During the survey, the survey team also surveyed various components and features, finding three areas containing observable contamination levels. These included the fire extinguisher mount on the east wall of Room 127, the unpainted tops of the sprinkler

[1] Rockwell International Report, N704TI990066, *Plutonium Concentrations in Soil Samples from the Nuclear Material Development Facility*, August 6, 1986.
[2] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.

pipes in Room 127, and the beams in Room 127. These were "cleaned and resurveyed to ensure a complete decontamination of the premises."

Upon completion of the survey, the surveyors also removed the flooring in the posted area, removed the fire extinguishers and mounts in the glove box room, removed the fire protection sprinkler system in the glove box room, scrubbed the beams in the glove box room, remove the lights from Room 130, removed paint from the east wall of the glove box room, and scrubbed the east emergency exit door.

Additionally, during periods of rain, water samples were collected from the area surrounding the building and were analyzed for Am-241 in a gamma spectrometer. The report indicated that all water samples did not contain Am-241. It should be noted the report did not provide the detection limits for Am-241 and did not provide any analytical results.

The report concluded that no residual contamination remained and that the facility met the 1986 release criteria for unrestricted use.[1]

- **1987 ORAU Radiological Survey.** Oak Ridge Associated Universities (ORAU) performed a radiological survey in July 1987 to confirm the 1986 Rockwell International final radiological survey. The survey covered Building 4055 and the surrounding area through a document review and measurements of direct radiation levels, contamination levels and soil contamination.

  The facility survey included the gridding of the floors and lower walls in the posted areas of Building 4055. ORAU performed surface scans, measurement of surface contamination levels, exposure rate measurements, paint sampling, soil sampling of the backfilled subfloor drain line trench, and miscellaneous media sampling. The miscellaneous media sampling included residue from anchor bolt holes in the radiologically controlled area of the building, as well as dust from a trench, air duct, and ceiling area.

  The exterior area survey included surface scans of outside areas adjacent to the building and a survey of the roof, exhaust vents and gutters. Additional exterior areas surveyed included the waste tank area. ORAU also performed exposure rate measurements, soil sampling, and water sampling from the waste tank retention well.

  Smears for the determination of removable contamination were counted for gross alpha and beta activity. Soils were analyzed by gamma spectroscopy for U-235, U-238, Am-241, and "other identifiable photopeaks." Paint samples, soils, and miscellaneous residues were analyzed for isotopic plutonium. The water sample was analyzed for gross alpha and gross beta concentrations. The results of these sampling activities were compared with "guidelines established by the NRC for release of facilities for unrestricted use."

[1] Rockwell International Report, N704SRR990027, *Final Radiation Survey of the NMDF*, December 19, 1986.

Surface scans revealed no areas of elevated beta-gamma or gamma contamination and one small area of elevated alpha contamination inside the building. Surface contamination measurements for alpha contamination were between the minimum detectable activity (MDA) (3 dpm/100 cm^2) and 120 dpm/100 cm^2 (NRC limit was 300 dpm/100 cm^2). All smears for removable alpha contamination taken after cleanup were below the limit for unrestricted use (NRC limit was 20 dpm/100 cm^2). Beta contamination measurements were between the MDA (480 dpm/100 cm^2) and 3,900 dpm/100 cm^2 (NRC limit was 5,000 dpm/100 cm^2). Removable beta contamination smears taken after cleanup was between the MDA (6 dpm/100 cm^2) and 23 dpm/100 cm^2 (NRC limit was 1,000 dpm/100 cm^2). Exposure rates ranged from 12 to 14 µR/hr compared to background levels of 10 to 13 µR/hr (Site criteria is 10 μR/hr above background). Soil samples showed contaminant concentrations of: U-235, <0.36 to <0.41 pCi/g (limit is 35 pCi/g); U-238, 1.7 to 5.1 pCi/g (limit is 35 pCi/g); Am-241, <0.11 to <0.13 pCi/g; Pu-238, <0.01to 0.01 pCi/g (limit is 25 pCi/g); Pu-239/240, <0.01 to 0.06 pCi/g (limit is 25 pCi/g).

The survey concluded that the facility satisfied the 1987 NRC requirements for release for unrestricted use. The document review found that the final survey was consistent with industry-accepted practices and the data supported the conclusions.[1]

- EPA conducted an oversight verification survey in 2001 for alpha, beta, beta-gamma radiation (total and removable) and gamma radiation. Surveys were performed to a quality level equal to a final status survey as defined by MARSSIM. The COCs for Building 4055 were transuranic compounds on the floors, walls, and ceilings. EPA also collected concrete core samples, which were analyzed for photon-emitting isotopes. Acceptable limits for the survey were consistent with NRC Regulatory Guide 1.86 and the proposed site-wide release criteria in the 1996 Area IV survey. None of the field measurements indicated the presence of radionuclides above 2001 acceptable limits. EPA field measurements confirmed the conclusions reached by both Rocketdyne and ORAU.[2,3]

[1] Oak Ridge Associated Universities Report, *Confirmatory Radiological Survey Nuclear Materials Development Facility (Building T-055), Rockwell International, Santa Susana, California*, July 1987.

[2] U.S. EPA Report, no document number, *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-011, T-019, T-055, and T-100*, December 20, 2002.

[3] Rocketdyne Document, A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.

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: Atomics International submitted a license application for the NMDF on June 24, 1966.[1] The application indicated the NMDF provided Atomics International the capability to perform research and development in the plutonium materials field in connection with the Fast Breeder Reactor program. Building 4055 was included in Special Nuclear Materials License No. SNM-21 for the possession and use of special nuclear material for the production of test and research reactor fuel elements, the development and testing of both irradiated and unirradiated nuclear fuels, and the associated research and development projects involved. The license required that all potentially contaminated liquid effluents from Building 4055 be analyzed prior to discharge. The license does not clearly provide information on the amount of plutonium that was permitted to be present in Building 4055 or at the SSFL. On December 17, 1982, Rockwell International requested that Building 4055 be removed from the license as a facility authorized for the possession and use of special nuclear materials, specifically for the research and development activities associated with plutonium fuels.[2,3] Building 4055 was removed from the license as an authorized facility to manufacture and perform research and development activities; however, plutonium in the form of Pu-239 remained under the materials license as a result of residual contamination at Building 4055. In addition, the building was retained as a contaminated facility until it could be decontaminated and released for unrestricted use.[4,5] On October 7, 1987, Building 4055 was officially removed from the Nuclear Regulatory Commission Special Nuclear Material License No. SNM-21 and released for unrestricted use.[6]

Use Authorization No. 88 was issued on March 4, 1975, to Rocketdyne for the use of 500 milligrams of plutonium in the form of metal and several chemical compounds (NBS isotopic

[1] Atomics International, *License Application for the Nuclear Materials Development Facility*, June 24, 1966.
[2] U.S. Nuclear Regulatory Commission, *Materials License*, SNM-21, September 15, 1977.
[3] U.S. Nuclear Regulatory Commission, NUREG-1077, *Environmental Impact Appraisal for Renewal of Special Nuclear Material License No. SNM-21*, June 1984.
[4] U.S. Nuclear Regulatory Commission, *Materials License,* SNM-21, June 28, 1984.
[5] Remley, M.E., Letter Re: Renewal of Special Nuclear Materials License No. SNM-21, Docket 70-25, December 17, 1982.
[6] Rouse, Leland, NRC Letter Re: SNM-21, Amendment No. 1, October 7, 1987.

standard – 93% Pu-239, 7% Pu-240) for a "plutonium radwaste combustion test." The license expired March 4, 1976, with no evidence of having been renewed.[1] The application for the use of the 500 mg of plutonium indicated that molten salt radwaste combustion process utilized a molten salt to decompose and burn in situ the organic material in the waste. All inorganic components were retained in the molten ash mixture.[2]

Use Authorization No. 115 was issued to Rocketdyne on March 10, 1979, for 455 kilograms of natural and depleted uranium and an unknown quantity of enriched uranium and plutonium. The approval, according to the initial authorization was based on an application dated March 10, 1978. The authorization indicated that the material would be utilized in a way so as to follow the procedures established for the control of plutonium contamination.[3] According to an internal letter regarding the renewal of Use Authorization No. 115, the major operation conducted at Building 4055 in 1979 was the fabrication of depleted uranium carbide blanket elements for FFTF. The letter indicated that this operation involved only depleted uranium; however portions of the facility, including the glove boxes and associated ventilation exhaust system, were contaminated with plutonium. As a result, the renewed authorization would continue to require radiological control measures for plutonium. The letter indicated that radioactive materials that would still remain present at Building 4055 in 1980 included approximately 19.8 kilograms of depleted uranium in oxide and carbide form, and enriched uranium and plutonium as contamination and gamma scanning standard.[4,5]

According to the internal letter dated February 22, 1982, regarding the renewal of the authorization, it was noted that during 1981, Building 4055 had been used for the decladding, oxidizing and repackaging of the AFS mixed carbide fuel pins and the oxidation of the scrap depleted uranium carbide left from the "blanket fuel project."[6] The use authorization remained unchanged until 1984, when the authorized material was the presence of residual contamination at Building 4055 and the building was being decontaminated and decommissioned. Isotopes listed in the authorization included source material, enriched uranium, and plutonium. The use specifications outlined by the authorization indicated that all procedures established for the control of plutonium contamination would remain in effect. The authorization dated 1986 indicated that the operations for the upcoming year included the disposal of the NaK bubblers, removal of the liquid waste system, and removal of the high volume exhaust system. The final use authorization was dated March 10, 1987, with an expiration date of March 10, 1988.[7,8,9]

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[1] Tuttle, R., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization No. 88, March 4, 1975.
[2] Grantham, L.F., Rockwell International Internal Letter Re: Application to Use Plutonium in Radwaste Combustion Tests, January 21, 1975.
[3] Mountford, L.A., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization No. 115A, March 10, 1979.
[4] Lang, J.F., Rockwell International Internal Letter Re: Renewal of Use Authorization No. 115, February 21, 1980.
[5] Mountford, L.A., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization No. 115B, March 10, 1980.
[6] Lang, J.F., Rockwell International Internal Letter Re: Renewal of Use Authorization No. 115, February 22, 1982.
[7] Horton, P.H., Letter Re: Renewal of Use Authorization No. 115, February 20, 1986.
[8] Mountford, L.A., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization No. 115F, March 10, 1984.
[9] Nagel, W.E., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization No. 115H, March 10, 1986.

Former Radiological Burial or Disposal Locations: According to a radiological contingency plan, wastes generated at Building 4055 may have been in gaseous, liquid, or solid form with the potential radioactive contaminants including uranium and plutonium. As indicated above, Building 4055 was equipped with a dual ventilation and gaseous-effluent control system for the management of gaseous effluents. A description of this system has been presented above.[1]

[redacted][2,3,4] [redacted][5,6,7]

[redacted][8]

[redacted][9,10]

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[1] Rockwell International Report, ESG-81-30, *Onsite Radiological Contingency Plan for Rockwell International Operations Licensed Under Special Nuclear Material License No SNM-21*, March 3, 1982.
[2] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[3] Oak Ridge Associated Universities Report, no document number, *Confirmatory Radiological Survey Nuclear Materials Development Facility (Building T-055), Rockwell International, Santa Susana, California*, July 1987.
[4] Rockwell International Report, N001TI000200, *Long-Range Plan for Decommissioning Surplus Facilities at the Santa Susana Field Laboratories*, Date Unknown.
[5] U.S. Nuclear Regulatory Commission, NUREG-1077, *Environmental Impact Appraisal for Renewal of Special Nuclear Material License No. SNM-21*, June 1984.
[6] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[7] Moore, J.D., Document No. AI-77-14, *Atomics International Environmental Monitoring and Facility Effluent Annual Report 1976*, Date Unknown.
[8] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[9] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[10] Rockwell International Report, ESG-81-30, *Onsite Radiological Contingency Plan for Rockwell International Operations Licensed Under Special Nuclear Material License No SNM-21*, March 3, 1982.

Solid compactable waste from Building 4055 was compacted into suitable containers, including metals cans and "ice cream cartons." These containers were then transferred via the "transfer tunnel" to the waste-handling box, where all items were bagged out of the glove box into 55-gallon drums. The 55-gallon drums were transferred for storage to Building 4064. Special items of unusual weight or shape such as filters and bulky equipment were bagged out directly from the box where they were used. Used filters were bagged out and treated as solid waste. If a sufficient amount of fuel material was contained on the used filter and required economical recovery, the filter would be transferred to a waste-handling glove box for reclamation. Details on this process were not available in the cited documents. The solid wastes were ultimately packaged in approved containers and shipped off site for commercial land burial or storage.[1,2,3]

Aerial Photographs: The area comprising the future Building 4055 area is agricultural land in 1952. By 1957, the area is under development. Buildings 4373 and 4374 have been constructed to the east of the future Building 4055 area. The building has been constructed by 1967 and a drainage channel is visible along 24th Street. The liquid waste system is also visible in the 1967 aerial photograph. The building is surrounded by a paved area to the north and west of the building. A fence-line is located east of the building around Buildings 4373 and 4374. In 1978, a possible vertical tank appears to be present south of the building near the smoke stack. The vertical tank to the south of the building no longer appears present in 1978; however, a possible vertical tank is located along the west perimeter of the building. A stain is visible on the paved area at the southwest corner of the building. The drainage channel along J Street is clearly defined in 1988 aerial photographs. The immediate area surrounding Building 4055 is very active in 1995. Numerous containers or vehicles are visible to the west and east of the building. In 2005, the site remains active with the presence of vehicles in the parking lots to the north of the building. Documents indicate that the waste system was removed; however, the concrete vault remains visible southeast of the building.[4]

Radionuclides of Concern: The primary special nuclear materials handled in the Building 4055 were plutonium and uranium. Accordingly the radionuclides of concern are uranium, Pu-239, and their decay and daughter products, primarily Am-241.[5,6] Decay products from U-235, U-238, and Th-232 decay chains include Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi212, and Tl-208. In addition, H-3, Sr-90, Cs-137, Na-24, Co-57, Co-60, Eu-152, and Am-243 would have been formed. All radionuclides of concern listed, with the exception of Na-24 and Co-57 (due to relatively short half-lives), are included in the EPA August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

[1] Rockwell International Report, ESG-81-30, *Onsite Radiological Contingency Plan for Rockwell International Operations Licensed Under Special Nuclear Material License No SNM-21*, March 3, 1982.
[2] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[3] Rockwell International, AI-76-21, *Environmental Impact Assessment of Operations at Atomics International Under Special Nuclear Materials License No. SNM-21*, April 30, 1976.
[4] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[5] U.S. Nuclear Regulatory Commission, NUREG-1077, *Environmental Impact Appraisal for Renewal of Special Nuclear Material License No. SNM-21*, June 1984.
[6] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.

Drainage Pathways: Surface water on the south side of the building drains south into an asphalt lined ditch that is located on the north side of J Street. Surface water on the west side of the building initially flows to the west into an asphalt lined ditch where it is carried to the north. Once surface water enters the ditch it flows to the north into an underground culvert that runs east, in front of the building. The surface water emerges from the culvert on the east side of the building and empties into another asphalt ditch that runs east to 22nd Street. Surface water on the east side of the building drains east into an asphalt lined ditch that runs to the north and also empties into the same east trending asphalt lined ditch. Surface water on the north side of the building drains to the north into the ditch that runs along the south side of G Street. All of the surface water in the vicinity of building 4055 eventually flows to the east via the ditch on the south side of G Street or the ditch on the north side of J Street and then on to Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4055 area is Class 1 based on previous site activities and incident reports.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4055 area. As discussed above, there were radiological incidents at Building 4055 and documented evidence of radiological releases. Significant information is lacking regarding the excavation activities of the drainage lines leading to the Building 4055 liquid waste holdup system.

In addition, previous characterization studies for the Building 4055 area were focused on delineating the extent of contamination to standards that were applicable at the time. And because the building remains present at the site, there have been limited site investigations of the area surrounding Building 4055. Additionally, characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4055 area. This includes the following Building 4055 areas and appurtenances:

- The former location of the underground drainage line from Building 4055 to the liquid waste holdup tank located southeast of the building. The drainage line ran within the western fenced boundary of Building 4373, discussed below, and ran west to Building 4055. As indicated above, Rockwell International performed a survey of the Building 4055 drain lines in 1986 to determine if any plutonium was left in the soil following removal. According to the 2005 HSA, the maximum measurements were 0.613 pCi/g of Pu-239 and Pu-240 and 0.0421 pCi/g of Pu-238. The 1986 acceptance limit was 25 pCi/g.[1] It is recommended that sampling be conducted along the entire length of the drain line to the former liquid waste holdup system.

- Building 4055 is an existing structure where active operations are occurring. EPA anticipates that Building 4055 will be demolished and removed in accordance with the DTSC/DOE AOC dated December 2010. Therefore, characterization beneath existing

[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. Citing Rockwell International Report, N704SRR9900124, *Plutonium Concentrations in Soil around Drain Lines at NMDF*, April 3, 1986.

structures will not be conducted until after the decontamination and decommissioning activities are complete.

- Sampling is recommended around the perimeter of the concrete parking, driveway, and storage areas specifically in the vicinity of former tanks, septic systems, and drain lines. Additionally, sampling should be conducted at any locations where surface water may drain form the concrete covered surfaces.

- Based on the above, it is also recommended that all adjacent surface drainage ditches in this area be sampled for potential contamination. Environmental monitoring reports indicated that liquid radioactive waste was not discharged to uncontrolled areas at the SSFL; however, information regarding the sampling of the tanks prior to discharge could not be located. [redacted][1,2]

2.2.5 Building 4373 Area

Site Description: The Building 4373 area includes Rockwell-owned Building 4373, pad 4848, a leach field, and the surrounding area at the corner of L Street and 22nd Street outside the boundary of the government-optioned land. Building 4373 was constructed in 1956 and included five bays comprising approximately 2,500 square feet.[3,4] The building served as the first SNAP critical facility. The building was initially connected to a leach field system and was serviced by pad 4848. Figures 2.2.5a through 2.2.5i 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: Constructed in 1956, Building 4373 was originally built for the testing and handling of highly explosive solid rocket fuels (see Figure 2.2.5c). Ownership of the building transferred from Rocketdyne to Atomics International Division in 1957 for use as the first SNAP critical facility. More specifically, a 1957 and 1958 progress report indicated the building's modification was to provide field test facilities for the performance of the "ANN" program.[5] One test cell was modified for critical assembly research supporting the SNAP program in 1957 by adding two feet of additional concrete shielding to two walls and installing a high-efficiency particulate air (HEPA) filter bank (see Figure 2.2.5d).[6,7]

A May 1962 Atomics International evaluation report provides a description of the Building 4373 facilities. According to the report, Building 4373 was constructed on a concrete foundation and floor slab and included 2,500-square feet of floor area. The test areas were separated from the

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[1] Rockwell International, ESG-82-33, *Health and Safety Sections for Renewal Application of the Special Nuclear Materials License SNM-21, Docket 70-25, Issued to Energy Systems Group of Rockwell International*, June 5, 1984.
[2] Rockwell International Report, ESG-81-30, *Onsite Radiological Contingency Plan for Rockwell International Operations Licensed Under Special Nuclear Material License No SNM-21*, March 3, 1982.
[3] Ashley, R.L., Atomics International Document No. NAA-SR-7300, *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities*, May 25, 1962.
[4] ETEC Document, GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[5] Atomics International, Facilities and Data Department, *Progress Report Fiscal Year 195 and Forecast Fiscal Year 1958*, January 1958.
[6] ETEC Document, GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[7] Rockwell International, A4CM-AN-003, *Area IV Characterization Survey Plan*, March 30, 1994.

administrative and general operating areas by a concrete shield wall. The test area building was approximately 62 feet long by 14 feet wide and contained a 14- by 11-foot fuel storage room, a 14- by 12-foot reactor test cell, and three adjacent cells (each 14- by 12-feet), that were used for miscellaneous non-nuclear tests that appear to have changed throughout the operation of the building.[1]

The cells were originally designed as explosion blowout rooms and were provided with 12-inch thick concrete inside walls. An additional 2 feet of magnetite concrete was added to the reactor test cell wall adjacent to the administrative area and 2 feet of ordinary concrete on the wall separating the reactor test cell and adjacent test cell. The facility roof consisted of metal joists and cemesto panels with built-up roofing material and did not include any shielding. The reactor test cell included a gas-tight door and a welded steel lining on all four walls, the ceiling and floor.[2] According to a February 1962 summary hazards report and operations manual for the SNAP 8 critical experiments to be conducted in the building, the location of the critical machine within the test cell had been changed at some time not documented in the report. According to the report, the structures of the previous "critical machines" had been removed from the cell. The document does not provide information to indicate how the previous critical machines had been disposed. A figure of the layout of the test cell shows the critical machine to be located in the center of the test cell.[3]

Based on information included in the 1988 survey report, Building 4373 was reportedly designed to contain radioactivity in the form of fissile material and activation foils; accordingly, no liquid radioactive waste was produced and no liquid radioactive waste holdup tanks were included at Building 4373.[4,5]

The administrative and general operating area, located on the opposite side of the shield wall from the test area, included a 9- by 11-foot change room that led to the fuel storage room and main test cell, a 20- by 20-foot L-shaped control room, a 20- by 32-foot laboratory area, a 7- by 12-foot instrument shop, a 12- by 11-foot equipment room, and a 10- by 41-foot office area. The building was surrounded by a chain-link security fence and included a secondary fence that prevented the use of the areas west and south of the main test cell. According to the report, the walls here "may not provide adequate shielding in the event of an excursion."[6]

The test cell ventilation system used a combination of air-filtration and air-conditioning system that enabled recirculation of the cell atmosphere or discharge of the atmosphere to a stack. During "normal" operations, and with the cell sealed, a fan recirculated the cell atmosphere through a bank of pre- and "absolute" filters and a cooler (or heater). When the reactor test cell door was opened, the ventilation system was converted automatically to a "once-through system.

[1] Ashley, R.L., Atomics International Document No. NAA-SR-7300, *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities*, May 25, 1962.
[2] Ashley, R.L., Atomics International Document No. NAA-SR-7300, *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities*, May 25, 1962.
[3] Thiele, A.W., Atomics International Document NAA-SR-MEMO-7029, *SNAP 8 Critical Experiment Summary Hazards Report and Operations Manual*, February 1, 1962.
[4] ETEC Document, GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[5] Author Unknown, *Facility Information Bldg 373*, Date Unknown.
[6] Ashley, R.L., Atomics International Document No. NAA-SR-7300, *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities*, May 25, 1962.

Approximately 500 cfm of air [was] drawn through the cell and filters and then mixed with 500 cfm of dilution air prior to discharge to the stack."[1]

According to January 1962 summary hazards report and operations manual, the fuel elements used in the building were stored in the fuel storage room in the shipping bird cages provided by "Fuel Fabrication." Only one bird cage was permitted in the test cell during fuel loading operations. No cages were permitted in the test cell during critical experiments.[2]

The building was initially connected to a leach field system until it was closed and abandoned once the site-wide sewage treatment system was installed and operational in 1960.[3,4]

Former Use(s): Constructed in 1956, Building 4373 was originally built for the testing and handling of highly explosive solid rocket fuels; however, information was not located in available documents to indicate these operations occurred. Ownership of the building transferred from Rocketdyne to Atomics International Division in 1957 for use as the first SNAP critical facility. One test cell was modified for critical assembly research supporting the SNAP program in 1957 by adding two feet of additional concrete shielding to two walls and installing a high-efficiency particulate air (HEPA) filter bank.[5,6] The SNAP critical assembly (SCA) had a pseudo spherical shape with a fixed hydrogen moderator, highly enriched U-235 fuel, and a beryllium and graphite reflector.[7]

According to the May 1962 Atomics International evaluation report, several critical experiments and tests on critical assemblies had been completed since 1957. The summary of the tests provided in the report are provided below: [8]

- SCA-1. Initiated October 1957. This assembly consisted of a pseudo sphere of zirconium hydride-enriched uranium dioxide blocks. Basic reactor parameters of the SNAP 2 reactor concept were determined.
- S2ER Critical Experiment. Initiated June 1959. The S2ER components were assembled and preliminary tests conducted at zero power.
- SCA-2. Initiated about September 1960. A clean, cylindrical geometry core was studied, using the core and reflector components from the conduction-cooled SNAP10 reactor.
- SCA-3. Initiated October 1961. An assembly of about a 1-cubic foot core volume was built to study the characteristics of the SNAP4 reactor. Plate-type fuel elements and a water coolant were used.

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[1] Ashley, R.L., Atomics International Document No. NAA-SR-7300, *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities*, May 25, 1962.
[2] Brehm, R.L., Atomics International Document No. NAA-SR-7011, *Summary Hazards Report and Operations Manual for SNAP Critical Assemblies 4A and 4C*, January 22, 1962.
[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. Citing Boeing Internal Document, no document number, *Radiation Survey Report, Building B373-Septic Tank*, December 7, 2000.
[4] Rockwell International, A4CM-AN-003, *Area IV Characterization Survey Plan*, March 30, 1994.
[5] ETEC Document, GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[6] Rockwell International, A4CM-AN-003, *Area IV Characterization Survey Plan*, March 30, 1994.
[7] ETEC Document, GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[8] Ashley, R.L., Atomics International Document No. NAA-SR-7300, *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities*, May 25, 1962.

Future experiments that were planned, but have not been confirmed included the following: [1]

- SCA-4C. This assembly was to use prototype SNAP2/10A core and reflector components, as a final design check on the flight reactor system. The test was tentatively scheduled to begin in mid-1962.
- S8ER Critical Experiment. The S8ER components were to be used to determine the nuclear parameters of the SNAP 8 reactor design. The test was tentatively scheduled to begin in mid-1962.
- SCA-4A. This assembly was to provide a flexible reflector assembly to permit optimum design of the reflector controls for the SNAP2/10A reactor. This test was tentatively scheduled to begin late in 1962.

The evaluation report indicated that following these tests, the facility was to be deactivated and that the critical experiment program would be continued in Building 4012 (discussed in EPA's upcoming HSA-6 TM).[2] Prior to being deactivated, a meeting held in March 1960 discussed the expanded use of Building 4373. According to a letter summarizing the meeting, it was recommended that the "water test room" adjacent to the critical assembly in Building 4373 be used for intermittent liquid metals tests. The letter stated that the measured dose in the room is 1 mrem/hour during operation of the critical assembly.[3] The letter did not indicate the nature of the liquid metals tests to be conducted.

According to numerous documents, SNAP critical tests in Building 4373 ceased in 1962 or 1963. However, an undated facility information sheet for Building 4373 indicated that a log book of the facility operations was kept and maintained in the control room.[4] Documents received to date have included the Building 4373 log book dated January 11, 1962, through May 28, 1965, that appear to indicate operations continued after 1963. A summary of select entries of the log book are presented below under the previous radiological investigations section. However, the log book indicates routine surveys of beryllium and birdcages containing 93% enriched uranium.[5] Additional available information is presented below.

An April 8, 1963, internal letter provided a summary of a March 20, 1963, meeting that provided a review of Building 4373 operations. According to the letter, Building 4373 was being used to test the SCA-4C in early 1963. The meeting summary indicated that the experimental program in Building 4373 was extensive despite previous correspondence indicating that Building 4373 was not recommended for a long-range program of critical experiments, due to "certain undesirable aspects of the ventilation system and the building design." However, it was reported the maximum credible accident for the facility assumed no containment and that changes to the ventilation system would require extensive modification to the building structure. It was recommended that Buildings 4012 and 4024 be used as much as possible for critical tests at the SSFL. The letter also indicated that the meeting recommended that "serious consideration should be given to using a weak source during fuel loading, in order to provide possible additional safety to personnel." The meeting minutes indicated that no source was used during

[1] Ashley, R.L., Atomics International Document No. NAA-SR-7300, *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities*, May 25, 1962.
[2] Ashley, R.L., Atomics International Document No. NAA-SR-7300, *Evaluation of the Atomics International Nuclear Development Field Laboratory as a Location for Reactor Facilities*, May 25, 1962.
[3] Jarrett, A.A., Letter Re: Expanded Use of Building 373, March 30, 1960.
[4] Author Unknown, *Facility Information Bldg 373*, Date Unknown.
[5] Log Book, Building 373, January 11, 1962 to May 28, 1965.

fuel loading in Building 4373 prior to this time.[1] The research team reviewed the entire collection of available documents provided by Boeing, DOE, and other sources and could not find information to indicate if a radioactive source was used in Building 4373 after March 1963. According to the log book for Building 4373, the SCA-4C was being dismantled in May 1963 for storage at Building 4005.[2]

In addition, Atomics International held a semiannual review of Building 4373 on September 16, 1964. According to the minutes of that meeting, Building 4373 continued to conduct experiments under the SNAP Critical Assembly Program. From March to September 1964, testing was completed in support of the SNAP-10B program. The meeting summary indicated the testing involved "the investigation of the worths of reflector under different arrangements, core critical loading measurements and materials reactivity effect studies." The experiments were classified in more detail, as follows:[3]

> Some experiments were studies involving materials such as samarium, gadolinium, and various fuel element cladding materials. In these experiments, the reactivity effects of the materials placed in the core were measured. Other experiments included studies of different types of control elements, and included the sliding drum, the tapered drum, and the split drum type.

The meeting minutes also indicated that Building 4373 would be used in the next six months in support of the SNAP-10B and SNAP 8 reactor concepts, and experiments would be conducted to obtain data on neutron lifetime, the worth of individual control drums and other reactor constants. The minutes indicated that an addendum to the Summary Hazards Report would be required for experiments relating to the SNAP-8 program, and the building would require modification. Documents were not located to indicate whether the building modifications required to accommodate the SNAP-8 program were made to Building 4373 following this meeting.[4]

The meeting summary indicated that no unusual incidents occurred during the "past survey period." It was reported; however, that a "slight case of U-235 foil contamination did occur." According to the minutes, "contamination levels were of minor concern and were easily cleaned up."[5]

According to a June 24, 1965, internal letter regarding a March 29, 1965, meeting and review of Buildings 4012 and 4373 for the use of poison-loaded Mylar films in critical experiments, Building 4373 had been approved for Mylar film experiments in SCA-4A and SCA-4B. The letter indicated the purpose of the experiments was to use Mylar films to introduce neutron absorbing material in experimental studies of proposed SNAP 2 and SNAP 10 reactor cores. The objective was to develop a reactor core that would be subcritical when immersed in water, but

[1] Remley, M.E., Internal Letter Re: Review of Bldgs 012 and 373 (NDFL) Recommendations and Minutes of Meeting of March 20, 1963, April 8, 1963.
[2] Log Book, Building 373, January 11, 1962 to May 28, 1965.
[3] Remley, M.E., Internal Letter Re: Semiannual Review of Building 373 – Recommendations and Minutes of Meeting of September 16, 1964, September 24, 1964.
[4] Remley, M.E., Internal Letter Re: Semiannual Review of Building 373 – Recommendations and Minutes of Meeting of September 16, 1964, September 24, 1964.
[5] Remley, M.E., Internal Letter Re: Semiannual Review of Building 373 – Recommendations and Minutes of Meeting of September 16, 1964, September 24, 1964.

would have the desired excess reactivity when filled with NaK and surrounded by the reflector and control drum assembly. The experiments were designed to have the fuel elements and core vessel have layers of gadolinium of several thicknesses. The gadolinium was to be attached with Mylar film. The experiments in Building 4373 were to be with dry cores.[1]

On June 8, 1965, Atomics International submitted comments on a draft reactor safety survey report dated April 22, 1965. The report was titled, "SNAP Critical Assembly-4A, Building 373." Atomics International provided the following additional information regarding the Mylar experiments being conducted in Building 4373:

> At the time of the survey an experiment was in progress to provide information that might result in the design of SNAP reactors that would be subcritical when accidentally immersed in water. This reduction in the reactivity of the water flooded and reflected systems as compared to the beryllium reflected system would be achieved through the use of an absorber with a strong low energy resonance, such as gadolinium, which would produce a shift in the effective energy of the neutrons causing fission. In this experiment the poison was in the form of gadolinium oxide applied to a Mylar film which was applied to either the fuel elements or to the core vessel as required by the experiments program.

The letter also stated that Atomics International was in the process of developing and implementing a procedure for the in-place testing of "absolute" filters, including those in Building 4373, which was to be done in the near future.[2] Available documents reviewed by the research team do not provide the results of those tests.

According to the log book, it also appears that Building 4373 served as a monitoring and tagging station for "birdcages" containing various fuels. According to a number of log book entries, birdcages were monitored and tagged at Building 4373 and were then shipped to Building 4064. A log book entry dated July 11, 1963, indicated that personnel "tagged and shipped 8 birdcages containing SNAP 10FS-1 backup fuel" to Building 4064. The same day, it was reported that the SCA-4 fuel would be returned to Building 4373 that day. On July 17, 1963, personnel monitored and tagged 8 birdcages containing SCA4 fuel to be shipped to Building 4064, and personnel received 4 birdcages containing S10FS-1 fuel. The entry that day indicated that "a total of 44 S10FS-1 fuel is now in" Building 4373. There are a number of additional references to the monitoring and tagging of birdcages at Building 4373; however, additional information regarding the nature and extent of these operations could not be located.[3]

At the conclusion of the SNAP critical tests, the facility was modified to include a non-nuclear liquid metal NaK test loop to support the SNAP Experimental Reactor. At this time, industrial planning maps refer to the building as a "critical cell and development test building," and is referred to as such until 1975, when industrial maps refer to the building as development test building. According to the undated facility information sheet for Building 4373, NaK experiments were conducted in the North Laboratory Room 102 and in the North Test Room 113. The small test loop was used to pre-test a NaK/NaK heat exchanger, EM pumps, electrical heaters, valves, piping, and instrumentation. Other non-nuclear test loop programs carried out in

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[1] Remley, M.E., Internal Letter Re: Review of Buildings 012 and 373 and the Use of Poison Loaded Mylar Films in the SCA-4A and -4B Experiments, Minutes of Meeting of March 29, 1965, June 24, 1965.
[2] Remley, M.E., Letter Re: Comments on Draft Report of Reactor Safety Survey Report, SNAP Critical Assembly-4A, Building 373, June 8, 1965. (Export Controlled Document)
[3] Log Book, Building 373, January 11, 1962 to May 28, 1965.

Building 4373 were RuK test loops, boiling mercury test loops and boiling potassium loops. The facility has since been used intermittently for storage of non-radiological materials.[1,2,3,4,5,6]

According to a 1988 survey report, Building 4373 had no significant radioactivity releases during its operation. Building 4373 was reassigned for non-nuclear use following a radiological survey of the building to ensure the area was "clean." Documents available to date did not include the referenced radiological survey. The report stated that "most" radioactive materials handled in Building 4373 were totally encapsulated or "in a condition which would not release radioactivity to the environment." Radioactive materials handled at the building included fully encapsulated highly enriched uranium. Activation foils were used for flux mapping in Building 4373.[7]

A July 1966 annual review of Building 4373 indicated that Building 4373 had been shut down "for some time." The review stated that the "SCA-4A machine" remained in Building 4373 and was being considered for transfer to Building 4012 for further operations. Based on a 1969 safety analysis report, the machine remained in Building 4373 in 1969. Atomics International received permission from the AEC to operate the SCA-4A in Building 4012 on February 12, 1970.[8,9,10]

In addition, the July 1966 annual review indicated that following the removal of fuel from the facility, a terminal radioactivity and beryllium survey was performed by Health and Safety. The results of this survey were not presented in the annual review report.[11] However, a 1984 letter regarding environmental assessments indicated that Building 4373 was contaminated with radioactive materials and that decontamination of the facility had been performed.[12] In 1987 the building was reported to be unoccupied, abandoned, and inactive, and to not have been used for over 20 years. It was requested that the building be cleaned out, the trash disposed of, and a post added to designate the building as "inactive."[13,14]

In 1988, Building 4373 was reported as being dilapidated inside with many of the interior walls removed. Conduit and miscellaneous debris was scattered about and hanging from the ceiling. The 1988 survey report described the building as a "mess."[15] In 1989, a search for alkali wastes

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[1] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[2] Rockwell International, A4CM-AN-003, *Area IV Characterization Survey Plan*, March 30, 1994.
[3] Rockwell International, Document No. N001ER000017, *Nuclear Operations at Rockwell's Santa Susana Field Laboratory – A Factual Perspective*, December 20, 1989.
[4] Author Unknown, *Facility Information Bldg 373*, Date Unknown.
[5] Atomics International, Santa Susana Map , July 14, 1964.
[6] Atomics International, Nuclear Development Field Laboratories, Santa Susana, March 1975.
[7] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[8] Remley, M.E., Atomics International Letter Re: Annual Review of Buildings 012 and 373 – Minutes of Meeting of May 3, 1966, July 7, 1966.
[9] Lahs, W.R., Atomics International Document SRR-696-13-001, *Review of SNAP Critical Facility Safety Analysis Report – Addendum for SCA-4A Operation: Recommendations and Minutes of Meeting held December 30, 1969*, January 13, 1970.
[10] Stamp, S.R., AEC Letter Re: Approval to Operate SCA-4A in the SNAP Critical Facility, Building 012, February 12, 1970.
[11] Remley, M.E., Atomics International Letter Re: Annual Review of Buildings 012 and 373 – Minutes of Meeting of May 3, 1966, July 7, 1966.
[12] Williams, R.O., Rockwell International Letter Re: Environmental Assessments, January 31, 1984.
[13] Schrag, F.C., Internal Letter Re: Building 373, SSFL, June 19, 1987.
[14] Schrag, F.C., Job Improvement Request, May 22, 1987.
[15] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.

was conducted by Rockwell International in Area IV. Sodium, potassium, or lithium were identified as being located in an old loop within Building 4373, indicating that the building had not been cleared of old equipment.[1] As of 1994, the building remained abandoned; however, it is unclear whether the condition of the building had been improved or changed since the 1988 survey report.[2]

In 1995, Rockwell International developed a demolition procedure for the demolition of the rubidium loop still located in Building 4373. According to the procedure report, the original loop was built in the early 1960s to investigate the heat transfer and fluid flow characteristics of boiling rubidium at temperatures of 1,400 to 1,800 ^{o}F. The loop had been fabricated of 3/8-inch stainless steel tubing, valves, heaters, condenser, and instrumentation supported within a steel angle iron frame structure. A “dump tank” was located at the bottom of the loop. The report stated that the system was drained in the mid-1960s and remained inactive since that time. As of 1995, the loop had also been cut open in four places and the power and instrument wiring had been disconnected. The report did not state if this occurred in the 1960s as well, or at a later date. The 1995 report provided demolition and removal procedures for the remainder of the loop so that Building 4373 could be released for demolition and removal. Certain components of the loop were placed in a 55-gallon drum and transported to the “Environmental Protection Waste Yard.” These components included: the condenser/sub cooler, boiler, pre-heaters, valves, expansion tank, dump tank, tubing connections, and fittings.[3]

The 2005 HSA stated that the facility was demolished in 1999.[4] A January 19, 1999, aerial view of the facility (Figure 2.2.5i) shows the exterior portions of the building removed and the concrete interior walls remaining.[5] The exact date of demolition of the entire facility is unknown based on available documents. According to a December 6, 2000, process hazards analysis for the septic tanks and systems removals at Buildings 4353, 4373, and 4143, the septic tanks holes were to be filled and the area was to be returned to natural terrain.[6] A January 3, 2001, email correspondence from Dan Trippeda indicated that the removal of the Building 4373 septic tank included the removal of the septic tank, distribution box, and leach field clay lines.[7]

Information from Interviewees: There have been no interviews relating to the operations in Building 4373 conducted, to date.

Radiological Incident Reports: There were no reported incident reports during the operational period of Building 4373. However, documents obtained by EPA from Boeing indicate that on September 23, 1963, an incident occurred involving a high airborne activity reading on the air monitor. During this incident, alpha activity was observed to rise from 50 to 200 cpm, and beta activity rose from 1,000 to 10,000 cpm. According to a February 1964 recounting of this incident, the cause of the temporary high reading was unknown, but was believed to have been

[1] Robinson, K.S., Rockwell International Internal Letter Re: Alkali Metal Waste in Area IV, January 22, 1989.
[2] Rockwell International, A4CM-AN-003, *Area IV Characterization Survey Plan*, March 30, 1994.
[3] Pendleberry, S., Document No. EWR-824906, *Demolition Procedure Demolition of Rubidium Loop in B/373*, May 1995. Export Controlled Document
[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.
[5] ETEC, Photo 395784, January 19, 1999.
[6] Unknown Author, *Process Hazards Analysis for the Septic Tanks and Systems Removals at Building 4353, 4373, and 4143*, December 6, 2000.
[7] Trippeda, Dan, Email Correspondence Re: 373 Septic Tank, January 3, 2001.

from naturally-occurring radioactive elements. This, according to the document, was "based on the fact that the incident is qualitatively reproducible by leaving the cell door open with the fan off, during certain weather conditions." The health physicist assigned to Building 4373 at that time, discounted the possibility of a fuel leak or fuel contamination because smear surveys did not show any contamination within the building. It was noted that the incident could have been related to an earthquake that had occurred early during that day.[1] Additional information regarding this incident could not be located.

A September 1964 semiannual review of Building 4373 operations indicated that "a slight case of U-235 foil contamination" occurred, but that "contamination levels were of minor concern and were easily cleaned up." Additional documentation regarding this contaminating incident could not be located in available historical documents.[2]

During the pre-demolition survey of Building 4373, on August 22, 1995, a Health Physicist (HP) found three radioactive prefilters in the ventilation system on the roof of Building 4373. According to the incident report, the filters were thought to have been in continuous use from 1957 to 1962 and were not replaced or removed since building operations ceased. The filters were removed and taken to Building 4020 for storage in a radioactive materials storage area. Following the removal of the prefilters, the ventilation system was surveyed and released, although the incident report did not provide the results of this survey. The survey results of each prefilter indicated 11,250 dpm/100 cm^2 of beta activity. Gamma spectroscopy determined that the activity was predominantly Cs-137. As a result, the incident report summarized that the high levels of Cs-137 were the result of building operations, as well as from atmospheric weapons testing. (Incident Report A0664).[3]

Current Use: The California Department of Health Services (DHS) released Building 4373 for unrestricted use on May 9, 1995.[4] The facility was demolished in 1999, and the septic tank was removed in 2000.

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

- As indicated above, the research team located a log book of Building 4373 dated from January 11, 1962, through May 28, 1965. The following table provides a summary of select entries of the log book. Additional information regarding the log entries could not be located and the information provided is as it was presented.[5]

[1] Remley, M.E., Atomics International Letter Re: Semiannual Survey of the SNAP Critical Facility and Minutes of Meeting of February 17, 1964, February 27, 1964.
[2] Remley, M.E., Atomics International Letter Re: Semiannual Review of Building 373 – Recommendations and Minutes of Meeting of September 16, 1964, September 24, 1964.
[3] Harcombe, Richard, Internal Letter Re: Radiological Incident Report A0664, August 25, 1995.
[4] Wong, Gerard, Letter Re: Release of Building 4373 and 4375, May 9, 1995.
[5] Log Book, Building 373, January 11, 1962 to May 28, 1965.

Building 4373 Select Log Book Entries
January 11, 1962 to May 28, 1965

Date	Log Entry
October 19, 1962	A smear survey was made of the birdcage that was decontaminated. The contamination level was <1 dpm α and <30 dpm βγ
October 19, 1962	A smear survey was made of 6 birdcages, reactor room, storage room, and change room. The results follow: All birdcage 3 dpm/100 cm^2 α to 60 dpm/100 cm^2 α < 30 dpm/100 cm^2 βγ to 250 dpm/100 cm^2 βγ
October 31, 1962	Called operations and told them the results of a smear survey taken on the birdcages and in the reactor vault. Everything was clean except for the tritium source. A smear was taken on the outside of the glass tube. 10,000 dpm tritium
November 5, 1962	Made a smear survey for tritium, beryllium, and βγ. Found four positive tritium smears in the reactor vault, three of these were on the neutron accelerator. 11,700 dpm end plate, 18,050 dpm first glass tube, 600 dpm on the aluminum pipe, 500 dpm on the mockup plate, all were tritium. Found on positive βγ near the outside of the RX vault door, 89 dpm βγ.
November 30, 1962	Monitored and tagged 8 birdcages containing 93% Enr. U. fuel elements. Smears showed <1 dpm α and <30 dpm βγ. All 8 birdcages were shipped to Bldg #064.
December 3, 1962	1100 - Monitored and tagged 6 birdcages containing 93% enriched U fuel elements. Birdcages read 0.8 mR/hr @ the surface. 1530 – Monitored and tagged 6 birdcages containing 93% enriched U fuel elements. All were <1 dpm α and <30 dpm βγ except one birdcage which was 24 dpm α. Fuel was the same batch as above.
December 4, 1962	Smeared out 5 birdcages for shipment to Bldg 64. Smeared critical assembly and components. There were less than 30 dpm. The control drums and drives are going to Bldg. #10 and the core container is going to Bldg 12.
January 22, 1963	A complete smear survey of the building was taken. [Beryllium] smears of the Snap 4 reactor, and tritium smears of the neutron-tritium target accelerator were taken. The results are listed below.* Tritium Smears in cpm** 1-A = 143, 2-A = 103, 3-A = 185, 4-A=Bkg, 5-A=Bkg, 6-A=Bkg
March 6, 1963	A smear survey of Bldg 373 revealed <30 dpm/100 cm^2 βγ. A high bkg level was encountered from Bldg 028, when these smears were being counted (1.83 – 30 dpm). Operations were notified and received their copy of the smear survey. Approx. 5 smears were counted on the manual counter to check the possibility that contamination exists. All smears indicated < 30 dpm/100 cm^2 βγ.
March 7, 1963	A smear survey was conducted on two birdcages containing fuel cladding and fuel. T he smear revealed the following: I. The birdcage containing one fuel rod (no cladding) Bottom of can, sides, and top – 125 dpm/100 cm^2 α, 50 dpm/100 cm^2 βγ Fuel rod – 140 dpm/100 cm^2 α, 50 dpm/100 cm^2 βγ II. The birdcage containing fuel cladding 4 fuel casings (cladding) – 28 dpm/100 cm^2 α, <30 dpm/100 cm^2 βγ
May 1, 1963	A smear survey of two birdcages containing 93% enriched fuel elements to be shipped to Bldg #64 revealed $1.3x10^3$ dpm α inside BC#2 and 30 dpm α on the outside. BC 105 revealed 80 dpm α inside and 9 dpm α outside. The operations crew was requested to decontaminate the cages on the outside prior to shipping.
June 24, 1963	A smear survey was conducted by H&S on 10ea birdcages at Building 373. The birdcages contained 10FS1 fuel elements. The birdcages were shipped to 373 from HQ. Results included:*** Cage #1 – small metal chips were found on the outside of the birdcage in the bottom corner – 3,400 dpm α and 5,000 dpm βγ (approx.)

Building 4373 Select Log Book Entries (continued)
January 11, 1962 to May 28, 1965

Date	Log Entry
November 11, 1963	Took Be smear of reactor, inserts, and parts bins. Sent them to HQ, made a radiation survey of a 10 min critical of a loading. The top of the reactor read 100 mR/hr, the center rod 120 mR/hr, the peripheral rods read 50 mR/hr a piece, the highest birdcage (with a load of 5 elements) read 2.5 mR/hr at the surface. Smear results: no βγ activity. However, α contamination was found inside the B of E containers and 18 dpm α was found in the corner of the lattice on a birdcage. No other α smear was over 8 dpm. Bkg was 0.1 cpm.
November 14, 1963	Received verbal results of Be smear survey conducted 11 Nov. 1 parts bin, 2 reflectors and the inserts were over allowable limits.
February 4, 1964	A smear survey at the request of [redacted] of the reactor room following the removal of foils from the reactor yielded the following" Reactor table – 4.4x10^3 dpm/100 cm^2 α, 6x10^3 dpm/100 cm^2 βγ Reactor room floor – 60 dpm/100 cm^2 α Change room floor – 15 dpm/100 cm^2 α Control room floor – 100 dpm/100 cm^2 α [Redacted] was notified and a follow-up survey initiated. Immediate decontamination was requested. The request was complied with.
February 25, 1964	A smear survey of Bldg 373 recorded the following: Reactor room and SS storage vault floor – ~ 10 dpm/100 cm^2 α average Change room floor – 12 dpm/100 cm^2 α Control room floor – ~4 dpm/100 cm^2 α average Hall floor – ~2 dpm/100 cm^2 α average Decontamination requested.
March 11, 1964	A smear survey of the reactor room, SS vaults, change room, and control room revealed contamination to be within permissible limits with the exception of one spot in the control room which was 2 dpm/100 cm^2 α.
April 14, 1964	Smear survey of reactor room, SS vault, change room, control room, and hall failed to reveal any significant α contamination.
July 31, 1964	Smear survey of reactor room indicated 2x10^2 dpm/100 cm^2 α on reactor table top. Reactor floor and adjacent area was <5 dpm/100 cm^2 α. Requested decon.

*The log book did not present any results of the beryllium smears.
**The locations (i.e. 1-A, 2-A) corresponded to a position on the neutron-tritium target accelerator.
***The research team did not provide the result of each of the birdcages measured and reported.
Bkg=background

- **1998 Rocketdyne Radiological Survey.** In 1988, Rocketdyne performed a radiological survey at Buildings 4373, 4374, and 4375 to determine if any residual contamination existed. The radiation measurements taken during the survey were compared against the DOE residual radioactivity limits specified in "Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites." The maximum acceptable contamination limits used in 1988 are presented below:[1]

[1] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.

1988 Maximum Acceptable Contamination Limits

Criteria	Alpha (dpm/100 cm2)	Beta (dpm/100 cm2)
Total Surface, averaged over 1 m2	5,000	5,000
Maximum Surface, in 1 m2	15,000	15,000
Removable Surface, over 100 cm^2	1,000	1,000
Ambient Gamma Exposure Rate	5 µR/hr above background*	

*The DOE guide recommended a value of 20 µR/hr above background for the ambient gamma exposure rate; however, the NRC required 5 µR/hr. Accordingly, Rockwell used the more stringent requirement.

According to the 1988 radiological survey, the survey included ambient gamma exposure rate measurements, surface smears and soil samples at Building 4373. The survey of the interior of the building included the floors, drains, and exhaust systems. The survey for the ambient gamma exposure rate of the exterior of the building included the surface between G and J Streets and from 22nd Street to the west fence. The average ambient gamma exposure rates (not adjusted for background) were 10.3 µR/hr for the Building 4373 interior, 9.3 µR/hr for the Building 4374 interior, and 12.6 µR/hr for the surrounding area compared to background measurements between 14.0 and 16.2 µR/hr (NRC limit is 5.0 µR/hr above background).[1] The removable alpha measurements were -0.063 dpm/100 cm^2 average and 2.8 dpm/100 cm^2 maximum (limit is 1000 dpm/100 cm^2). The removable beta measurements were -0.47 dpm/100 cm^2 average and 10.1 dpm/100 cm^2 maximum (limit is 1000 dpm/100 cm^2). The total beta activity measurements found no detectable activity. Survey results found that the areas were acceptably clean by the DOE and NRC guidelines and that no further inspection was required.[2]

- **1996 Rocketdyne Radiological Characterization.** During the 1996 Area IV Radiological Characterization Survey, soil samples were collected and analyzed as part of the Area IV radiological characterization. Randomly selected, two soil samples were taken in the vicinity of Building 4373 (samples 95-0058 and 95-0059), as well as at the inactive sanitary leach field at Building 4373 (samples 95-0011 and 95-0012). The report stated that the septic tank and a single clay pipe stub from the tank were exposed at the surface as a result of erosion. Personnel dug in the opposite bank of the eroded channel and located the start of gravel. Samples were taken from just downstream of the start of the gravel and approximately 10 feet further downstream. According to the report, none of the measurements were distinguishable from background and all measurements were below the acceptable concentration levels established by Boeing in the 1998 approved site-wide release criteria for remediation of radiological facilities. Additionally, located in the central portion of survey block I13, the ambient gamma survey results in the vicinity of Building 4373 measured between 12.6 and 15.3 µR/hr.[3,4]

- **2000 Boeing Radiological Survey of Soil Surrounding Septic System.** According to the 2005 HSA, Boeing also performed a radiological survey of the soil surrounding the

[1] According to the 1988 survey report, an average of 38 background measurements were taken at three locations at the SSFL – the Building 4309 area, Well #13 Road, and Incinerator Road.
[2] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[3] Rocketdyne, Report No. A4CM-ZR-0011, *Area IV Radiological Characterization Survey Final Report*, August 15, 1996.
[4] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.

septic system in 2000. The research team is in the process of obtaining this report from Boeing; however, according to the information presented in the 2005 HSA, all removable and total contamination measurements of the septic tank were non-detect. As reported in the 2005 HSA, all soil sampled showed no contamination levels above background and all measurements met limits for unrestricted use. Removable alpha measured <20 dpm/100 cm^2, removable beta measured <100 dpm/100 cm^2, total alpha measured no detectable activity, and total beta measured no detectable activity. Ambient gamma was between 8 and 10 μR/hr.[1]

Radiological Use Authorizations: According to a January 11, 1990, letter to the DOE from Rockwell International, at the start of research with nuclear materials at the SSFL, the Atomics International operations were conducted under the authority of the Chicago Operations Office of the AEC. At the time, all work performed for the Chicago Operations Office was considered to be exempt from licensing. Following the transfer of Atomics International programs to the San Francisco Operations Office, only those operations conducted on government-optioned land were determined to be exempt from licensing. The Building 4373 area was not located within the government-optioned land boundaries, but, according to the letter, Building 4373 was "shut down and cleaned out" prior to the transfer of operations from the authority of the Chicago Operations Office to the San Francisco Operations Office.[2] As a result, Building 4373 was never included in any licenses during its period of operations under the SNAP program.

Former Radiological Burial or Disposal Locations: The building was initially connected to a leach field system until it was closed and abandoned once the site-wide sewage treatment system was installed and operational in the early 1960s.[3] No other radiological burial or disposal locations have been identified at the Building 4373 area, with the exception of a liquid waste pit located southwest of Building 4373 and visible in the Building 4373 plot plan. This liquid waste pit was associated with the operations of Building 4055 and is discussed above.

Aerial Photographs: In 1952, the area comprising the future Building 4373 area is agricultural land. By 1957, the building has been constructed and possible standing liquid is seen to the west of the building. In 1959, the building area is more developed and Building 4374 is clearly visible to the north of Building 4373. A fence surrounds the perimeter of the building and a large parking area has been developed to the east of the building, on the other side of 22nd Street at the future location of Building 4015, discussed in the HSA-5C TM. A drainage channel is located north of the building along G Street. The area remains relatively unchanged in the 1962/1963 aerial photograph. In 1965, the Building 4373 area remains unchanged. The 1967 aerial photographs show the addition of the liquid waste pit southwest of Building 4373 within the former fence boundary of the building area. In addition, a parking area has been established north of Building 4373 and 4374, outside the fenced perimeter. 1978 aerial photographs show a possible buried pipeline extending from the liquid waste pit northward through the fenced boundary of the Building 4373 area, and then west toward Building 4055. The aerial photograph

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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. Citing Boeing Internal Document, no document number, *Radiation Survey Report, Building B373-Septic Tank*, December 7, 2000.
[2] Lancet, R.T., Letter Re: DOE Authority for Release of Certain Facilities at SSFL, January 11, 1990.
[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. Citing Boeing Internal Document, no document number, *Radiation Survey Report, Building B373-Septic Tank*, December 7, 2000.

interpretation also notes the presence of a probable stain south of the building along J Street. By 1980, the area surrounding the building is becoming vegetated. The stain appears to remain present along J Street. In 1988, the Building 4373 area shows the presence of dark-toned material at the northeast corner of the building. Also, a new building has been constructed to the north of the Building 4373 area. By 1995, the building appears to be under demolition and a possible stain is located east of the building, just west of 22nd Street. By 2005, the Building 4373 and 4374 area is vegetated and the new building constructed sometime between 1983 and 1988 is no longer present. The only feature remaining in 2005 is the liquid waste pit.[1]

Radionuclides of Concern: Most nuclear or radioactive materials handled at Building 4373 were fully encapsulated. Only fissile material and activation foils produced low levels of radioactivity.[2] Based on available information, the radionuclides of concern are uranium, plutonium, and their decay and daughter products. Decay products from U-235, U-238, and Th-232 decay chains include Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi212, and Tl-208. In addition, H-3, Sr-90, Cs-137, Na-24, Co-57, Co-60, Eu-152, and Am-243 would have been formed. All radionuclides of concern listed, with the exception of Na-24 and Co-57 (due to relatively short half-lives), are included in the EPA August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

Drainage Pathways: Drainage around the Building 4373 appears to have been to the north and to the south. A 1964 plot plan shows a drainage channel located at the northeast corner of the fence boundary that leads north along 22nd Street to the parking lot entrance, flows under the parking lot entrance through an 18-inch corrugated metal pipe, and continues to a catch basin located at the intersection of G Street and 22nd Street. The flow from the catch basin is directed through a 36-inch corrugated metal pipe under 22nd Street and into a natural drainage ditch that flows east-southeast toward Area III. Drainage from the southern portion of the building appears to have been directed to a 24-inch corrugated metal pipe near the southeast corner of the building, under 22nd Street, and eastward along J Street toward Area III.[3]

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4373 area is Class 1 because of the building's former operations as a critical facility in support of the SNAP program.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4373 area. Building 4373 included a SCA that had a pseudo spherical shape with a fixed hydrogen moderator, highly enriched U-235 fuel, and a beryllium and graphite reflector.[4]

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

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[3] Atomics International, Drawing No. 303-GEN-C41, Sheet 7 of 14, Santa Susana Facility Plot Plan,
[4] ETEC Document, GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.

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

- Sampling is recommended in the drainage channels surrounding Building 4373. This includes drainage channels to the north and south of the building. A 1964 plot plan shows a drainage channel located at the northeast corner of the fence boundary that leads north along 22nd Street to the parking lot entrance, flows under the parking lot entrance through an 18-inch corrugated metal pipe, and continues to a catch basin located at the intersection of G Street and 22nd Street. The flow from the catch basin is directed through a 36-inch corrugated metal pipe under 22nd Street and into a natural drainage ditch that flows east-southeast toward Area III. Drainage from the southern portion of the building appears to have been directed to a 24-inch corrugated metal pipe near the southeast corner of the building, under 22nd Street, and eastward along J Street toward Area III.[1]
- Sampling is also recommended at the former Building 4373 leach field located southeast of the building. Limited information regarding the abandonment of the leach field has been located.
- The former Building 4373 footprint is recommended for sampling, including the former location of the SCA.
- As indicated above, the underground drainage lines of Building 4055 were located to the west of Building 4373 within the facility's fenced boundary. The sampling of these lines is recommended under Building 4055.

2.2.6 Building 4374 Area

Site Description: Located north of Building 4373, the Building 4374 area includes Building 4374 and the surrounding area west of 22nd Street, outside the government-optioned area. Building 4374 was constructed in approximately 1957 and was an AEC-owned Butler-type building measuring approximately 420 square feet.[2,3] Figures 2.2.6a through 2.2.6c 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 4374 was an AEC-owned single story steel frame and sheet metal covered Butler-type building measuring approximately 420 square feet located a few feet north of Building 4373.[4,5] Historical information or drawing showing the building layout could not be located; however, a March 15, 1962, facility layout of Buildings 4373 and 4374 shows the

[1] Atomics International, Drawing No. 303-GEN-C41, Sheet 7 of 14, Santa Susana Facility Plot Plan,
[2] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[3] Stafford, K.T., ETEC, *Site Consolidation Assessment*, April 16, 1987.
[4] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[5] Stafford, K.T., ETEC, *Site Consolidation Assessment*, April 16, 1987.

building to have included two rooms identified as Room 120 and 122 (see Figure 2.2.6b).[1] The building does not appear, based on a 1964 plot plan, to have been connected to any utilities.[2]

Former Use(s): Limited historical information has been located regarding the operations of Building 4374. Unlike Building 4373, which was owned by Atomics International and Rockwell International, Building 4374 was owned by the AEC.[3,4] Based on SNAP weekly highlight memoranda, Building 4374 appears to have served as a test facility for pumps to be used in a "Mercury Rankine Program." The "Mercury Rankine Program" was reported to have had the objective of developing a broad-based component and system test technology that could be utilized in a space flight application for reliable electrical power generation. Building 4374 was involved in the component test services to perform acceptance, prequalification, and qualification testing of all mercury system components used in the Mercury Rankine Program.[5]

According to memoranda indicated above, Building 4374 included a mercury monitor and a boiler test loop/rig. In April 1965 it was reported that a pump installed in the boiler test rig in Building 4374 had operated upstream of the boiler during 3 Mercury injections. Data indicated the system was stable with the flow regulator upstream of the pump. It was reported that "at steady state conditions, the pump was performing normally as in the acceptance test facility."[6],[7],[8],[9] Memoranda and the 1965 progress report also indicated that the building included the orbital startup component test loop (OSCTL). This loop performed boiler operation tests, boiler flow regulator calibration, boiler conditioning operation, boiler acceptance testing, and "TEM" pump testing.[10]

According to the 1988 survey report, Building 4374 was built to test non-nuclear liquid metal heat transfer loops and was used as a support facility for Building 4373. Industrial planning maps identify the building as a sodium loop enclosure in 1962 and as a test loop enclosure building beginning in 1964.[11,12] The 1987 site consolidation assessment also stated that Building 4374 was used for SNAP program NaK loop testing.[13] According to the 1988 survey report, the handling of radioactive materials in Building 4374 is unknown. The site consolidation assessment states that following the termination of the SNAP program, Building 4374 was used intermittently for miscellaneous storage activities, but mostly remained inactive. The assessment

[1] Unknown Author, Figure 45, *Building Area and Room Numbering Plan, Buildings 373 &374*, March 15, 1962.
[2] Atomics International, Drawing No. 303-GEN-C41, Sheet 7 of 14, Santa Susana Facility Plot Plan,
[3] ETEC, Industrial Planning Maps, 1962 – 1992.
[4] Stafford, K.T., ETEC, *Site Consolidation Assessment*, April 16, 1987.
[5] Atomics International, NAA-SR-11491, Volume 1, *Progress Report SNAP Systems Improvement Program, Mercury Rankine Program, April – June 1965*, August 15, 1965.
[6] Graves, A.W., Hydraulic Equipment and Testing Unit, NAA-SR-MEMO-10203, *SNAP Weekly Highlights for Week Ending 7-10-64*, July 10, 1964.
[7] Poucher, F.W., Mercury Rankine Program Test Planning and Evaluation Unit, NAA-SR-MEMO-10223, *SNAP Weekly Highlights for Week Ending 7-10-64*, July 11, 1964.
[8] Perlow, M.A., Mercury Rankine Program, NAA-SR-MEMO-11125, *SNAP Weekly Highlights for Week Ending 3-5-65*, March 5, 1965.
[9] Perlow, M.A., Mercury Rankine Program, NAA-SR-MEMO-11248, *SNAP Weekly Highlights for Week Ending 4-9-65*, April 9, 1965.
[10] Atomics International, NAA-SR-11491, Volume 1, *Progress Report SNAP Systems Improvement Program, Mercury Rankine Program, April – June 1965*, August 15, 1965.
[11] Atomics International, Industrial Planning Map Nuclear Development Field Laboratories, Santa Susana, March 15, 1962.
[12] Atomics International, Santa Susana SRE Facility Map, July 14, 1964.
[13] Stafford, K.T., ETEC, *Site Consolidation Assessment*, April 16, 1987.

did not indicate the type of material stored in Building 4374. As of 1988, Building 4374 was abandoned and contained an old mercury test loop. Building demolition began in May 1989 and by August 1990, the building had been demolished.[1,2,3,4] Available documents do not indicate that the building required release from either the State of California or the DOE prior to demolition.

Information from Interviewees: There have been no interviews relating to the operations in Building 4374 conducted, to date.

Radiological Incident Reports: There have been no radiological incident reports associated with the operations in Building 4374 located to date.

Current Use: Building demolition began in May 1989 and by August 1990, the building had been demolished.[5,6]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): In 1988, Rocketdyne performed a radiological survey at Building 4373 and Building 4374 to determine if any residual contamination existed. The radiation measurements taken during the survey were compared against the DOE residual radioactivity limits specified in "Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites." The maximum acceptable contamination limits used in 1988 are presented in Section 2.2.5, above.

According to the 1988 radiological survey, the Building 4374 survey included a survey of the gamma exposure rate of the surface of the building and the grounds between G and J Streets and from 22nd Street to the west fence. A combined total of 29 gamma exposure rate measurements were taken within Buildings 4374 and 4375, and 25 smears were collected in Building 4373. The report indicated that no soil samples were collected because there was no indication of contamination as a result of the gamma exposure rate measurements. As indicated above, the measured ambient gamma limit was < 5 μR/hr above background, which was measured to be between 14 and 16 μR/hr.[7] The maximum measured ambient gamma in Buildings 4374 and 4375 was 9.3 μR/hr, and 12.6 μR/hr for the area surrounding Buildings 4373 and 4374. The survey concluded that survey results were below the 1988 Rocketdyne acceptable limits and no further inspection was required at Building 4374.[8]

During the 1996 Area IV Radiological Characterization Survey, soil samples were collected and analyzed as part of the Area IV radiological characterization. Randomly selected, two soil

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[1] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[2] Stafford, K.T., ETEC, *Site Consolidation Assessment*, April 16, 1987.
[3] Lafflam, S.R., Letter Re: Buildings 028 and 374, Area IV SSFL – Asbestos Removal and Demolition, May 2, 1989.
[4] Gaylord, G.G., Rockwell International Internal Letter Re: Fire Protection Appraisals for DOE Building, August 7, 1990.
[5] Lafflam, S.R., Letter Re: Buildings 028 and 374, Area IV SSFL – Asbestos Removal and Demolition, May 2, 1989.
[6] Gaylord, G.G., Rockwell International Internal Letter Re: Fire Protection Appraisals for DOE Building, August 7, 1990.
[7] According to the 1988 survey report, an average of 38 background measurements were taken at three locations at the SSFL – the Building 4309 area, Well #13 Road, and Incinerator Road.
[8] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.

samples were taken in the vicinity of Building 4373 (samples 95-0058 and 95-0059). These samples were also located near Building 4374. As reported above, none of the measurements were distinguishable from background and all measurements were below the acceptable concentration levels established by Boeing in the 1998 approved site-wide release criteria for remediation of radiological facilities. Additionally, located in the central portion of survey block I13, the ambient gamma survey results in the vicinity of Building 4374 measured between 12.8 and 15.0 μR/hr.[1,2]

Radiological Use Authorizations: There have been no radiological use authorizations identified relating to the operations in Building 4374.

Former Radiological Burial or Disposal Locations: No radiological burial or disposal locations have been identified at the Building 4374 area, with the exception of a liquid waste pit located southwest of Building 4373 and visible in the Building 4373 plot plan. This liquid waste pit was associated with the operations of Building 4055 and is discussed in Section 2.2.4, above.

Aerial Photographs: In 1952, the area comprising the future Building 4374 area is agricultural land. By 1957, the building has been constructed and possible standing liquid is seen to the west of the building. In 1959, the building area is more developed and Building 4374 is clearly visible to the north of Building 4373. A fence surrounds the perimeter of the building and a large parking area has been developed to the east of the building, on the other side of 22nd Street at the future location of Building 4015, discussed in the HSA-5C TM. A drainage channel is located north of the building along G Street. The area remains relatively unchanged in the 1962/1963 aerial photograph. In 1965, the Building 4374 area remains unchanged. The 1967 aerial photographs show the addition of the liquid waste pit southwest of Building 4373 within the former fence boundary of the building area. In addition, a parking area has been established north of Building 4374, outside the fenced perimeter. 1978 aerial photographs show a possible buried pipeline extending from the liquid waste pit northward through the fenced boundary of the Building 4373 and 4374 area, and then west toward Building 4055. By 1980, the area surrounding the building is becoming vegetated. In 1988, the Building 4374 area shows the presence of dark-toned material east of the building. Also, a new building has been constructed to the north of the Building 4374 area. By 1995, Buildings 4373 and 4374 appear to be under demolition and a possible stain is located east of the building, just west of 22nd Street. By 2005, the Building 4373 and 4374 area is vegetated and the new building constructed sometime between 1983 and 1988 is no longer present. The only feature remaining is the liquid waste pit.[3]

Radionuclides of Concern: According to the 1988 survey report, the use of radioactive material in Building 4374 is unknown. Building 4374 may have been used to support operations in Building 4373, which, according to the report, may have introduced activation foils and other radioactive materials to Building 4374.[4] However, historical documents have not been located to determine whether radioactive materials were ever used or stored in Building 4374. As a result, the radionuclides of concern at Building 4374 are uranium, plutonium, and their decay and

[1] Rocketdyne, Report No. A4CM-ZR-0011, *Area IV Radiological Characterization Survey Final Report*, August 15, 1996.
[2] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.
[3] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[4] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.

daughter products.[1,2] Decay products from U-235, U-238, and Th-232 decay chains include Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi212, and Tl-208. In addition, H-3, Sr-90, Cs-137, Na-24, Co-57, Co-60, Eu-152, and Am-243 would have been formed. All radionuclides of concern listed, with the exception of Na-24 and Co-57 (due to relatively short half-lives), are included in the August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

Drainage Pathways: Similar to Building 4373, drainage around the Building 4374 appears to have been to the north and to the south. A 1964 plot plan shows a drainage channel located at the northeast corner of the fence boundary that leads north along 22nd Street to the parking lot entrance, flows under the parking lot entrance through an 18-inch corrugated metal pipe, and continues to a catch basin located at the intersection of G Street and 22nd Street. The flow from the catch basin is directed through a 36-inch corrugated metal pipe under 22nd Street and into a natural drainage ditch that flows east-southeast toward Area III. Drainage from the southern portion of the building appears to have been directed to a 24-inch corrugated metal pipe near the southeast corner of the building, under 22nd Street, and eastward along J Street toward Area III.[3]

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4374 area is Class 1 because of the building's proximity to Building 4373, which operated as a critical facility, and the unknown nature of operations in Building 4374.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4374 area. Significant historical information is lacking regarding the operations of Building 4374, as well as the demolition of the building.

In addition, previous characterization studies for the Building 4374 area were focused on delineating the extent of contamination to standards that were applicable at the time. In addition, characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4374 area. This includes the following Building 4374 areas and appurtenances:

- Sampling of the former building footprint is recommended as a result of the limited information on building operations that is presently available.
- Sampling is also recommended in the surrounding drainage pathways; however, these are the same drainage channels identified for Building 4373 above. The sampling of these drainage channels should be included in the Building 4373 and Building 4374 sampling plans.

[1] U.S. Nuclear Regulatory Commission, NUREG-1077, *Environmental Impact Appraisal for Renewal of Special Nuclear Material License No. SNM-21*, June 1984.
[2] Rockwell International Report, AI-DOE-13559, *Nuclear Materials Development Facility Decommissioning Final Report*, March 31, 1987.
[3] Atomics International, Drawing No. 303-GEN-C41, Sheet 7 of 14, Santa Susana Facility Plot Plan,

2.2.7 Building 4173(4865) Area

Site Description: The Building 4173(4865) area comprises Building 4173, former Building 4865, and the surrounding area at the end of 24th Street. Building 4173 is reported to have served as a sodium storage pad and Gammagraph building. Figures 2.2.7a through 2.2.7b provide a current photograph and a plot plan of the building. Building-specific facility drawings for Building 4173(4865) could not be located. Plate 1 presents a summary of all identified features for this site.

Building Features: Industrial planning maps do not show any indication that a permanent building existed at the Building 4173(4865) area. Aerial photographs have shown a pad, unidentified object, and a possible vertical storage tank to have been located at the Building 4173(4865) area. The Building 4173(4865) area was not connected to the sanitary sewer system at the SSFL.[1]

Former Use(s): Industrial planning maps show the presence of a sodium storage pad (Building 4865) in 1962; however, available documents do not indicate the type of storage activities that may have occurred at this time.[2] A July 13, 1965, internal letter indicated Building 4173 included a radiography installation. The letter indicated that in the event of a radiological emergency (e.g., source stuck out of shield, broken cable, etc.), the operator was instructed to leave Building 4173 to reach a telephone in Building 4363 or Building 4020. The letter applied only to the use of a 30 curie Ir-192 source.[3] By 1967, the area was being used as a Gammagraph x-ray site and was identified as Building 4173.[4] The pad, according to the May 2005 HSA, housed a sealed gamma-emitting source for x-ray purposes, which is supported by an incident report documented below.[5] The exact operational time period of this area is unknown; however aerial photographs show the area to be under development beginning in 1957 and the presence of a pad until approximately 1995.[6]

Information from Interviewees: There have been no interviews relating to Building 4173(4865) identified to date.

Radiological Incident Reports: There has been one documented incident associated with Building 4173(4865) 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 the incident reports are provided following the table, when available.

[1] Rocketdyne Document A4CM-AN-0003, Rev. A, *Radiological Characterization Plan*, March 30, 1994, p. 2-11
[2] Atomics International, Nuclear Development Field Laboratories Industrial Planning Map, Santa Susana, March 15, 1962.
[3] Tschaeche, A.N., Atomics International Internal Letter Re: Building 173 – Evaluation for Radiological Emergency Procedure, July 13, 1965.
[4] Atomics International, Nuclear Development Field Laboratories Industrial Planning Map, Santa Susana, January 1, 1967.
[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.
[6] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

Building 4173(4865) Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0066	4/21/1978	Field	Co-60	Radiographic source projector fell and damaged the source guide tube.

- On April 21, 1978, two weld test samples were being radiographed by two Rockwell International personnel using a Tech/Ops Model 680 source projector, containing approximately 90 Curies of Co-60, with a depleted uranium collimator, Model 719, and stand for the directional 60^o beam. During the placement of the film under the test samples, the stand supporting the uranium collimator was accidentally pushed over on its side, causing damage to the source guide tube. The source guide tube was removed, red tagged, and replaced with a new source tube. According to the incident summary, the two employees received two mrem of exposure in the process (Incident Report A0066).[1] The incident report does not provide information to indicate where the damaged source guide tube was disposed of, or if it was contaminated at the time of disposal.

Current Use: According to the May 2005 HSA, the sodium pad is empty and the Gammagraph is no longer in use.[2] Aerial photographs from 2005 do not show the presence of any structures in the former Building 4173(4865) area. The area comprising this former area includes a dirt road, but no other evidence of previous activities remains.[3]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4173 have not been conducted; however, according to the Area IV Radiological Characterization Survey, the area was included in the survey conducted in 1994 and 1995. Located in survey block F12, the Building 4173(4865) area ambient gamma survey results measured between 15.2 and 15.5 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Building 4173(4865) area were found to be below the then-acceptable limits.[4]

Radiological Use Authorizations: No radiological use authorizations associated with the operations of Building 4173(4865) have been located to date.

Former Radiological Burial or Disposal Locations: There have been no on-site radiological burial or disposal locations identified during the operational period of the Building 4173(4865) area operations. However, aerial photographs show excavation activities north of the Building 4173(4865) area. These features were identified by the aerial photograph interpretation as relating to a pond dredge area. Additional information regarding these features is presented below.[5]

[1] Vandervort, P.S., Rockwell International Internal Letter Re: Field Radiography at LMEC-Damaged Source Tube, A0066, April 25, 1978.
[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.
[3] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[4] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.
[5] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

Aerial Photographs: In 1952, the area comprising Building 4173(4865) is agricultural land. By 1957, 24th Street has been graded, and the future area of Building 4173(4865) has been excavated and is under development. Directly to the west of the Building 4173(4865) area, ground scarring is visible from the buried water pipeline originating from tanks located at the top of the hill located south of Building 4173(4865). The area east of Building 4173(4865) is under development with a number of roadways intersecting the area. By 1959, a number of the roadways are vegetated and are no longer present. The area of Building 4173(4865) shows the presence of a pad and an "unidentified object" in the 1959 aerial photographs. The ground scarring from the buried water pipeline remains visible to the west, and two possible crates and light toned material are visible north-northeast of the Building 4173(4865) area east of 24th Street at the end of a short dirt road. In 1959, outside storage is also visible east of the Building 4173(4865) area, just south of L Street and the location of Building 4353, which appears to be under development. A trench is also present in 1959 that extends from H Street to the west, past the Building 4173(4865) area, then east-southeast toward Area III. The trench appears to originate from the access road leading to Site 4885, discussed in the HSA-8 Technical Memorandum.

In 1962, the pad remains visible and two light-toned objects are observed. Ground scarring from the buried water pipeline remain visible and the short dirt road visible north-northeast of the Building 4173(4865) area remains present. The end of the dirt road appears to contain disturbed ground, two small light-toned objects and possible dark-toned material. The area of outside storage from 1959 south of Building 4353 is no longer present. The 1965 aerial photographs show 24th Street to be more defined (possibly recently paved), and a probable vertical tank at the Building 4173(4865) area. The short dirt road is no longer visible and appears to have been graded. The trench remains visible. A roadway extends from the Building 4173(4865) area westward to H Street and follows the curve of the base of the hill.

In 1967, the Building 4173(4865) area is relatively unchanged. However, the area surrounding the buildings appears to be under development. There are numerous linear ground scars north, west, and east of the Building 4173(4865) area. By 1972, these ground scars are partially re-vegetated. A possible shed is also present at the Building 4173(4865) area in 1972. In 1978 the shed remains visible and the area surrounding the Building 4173(4865) area remains vegetated. The roadway first visible in 1965 remains present and is more defined by 1978. The area remains unchanged until 1995, when the pad is no longer visible and the area immediately north of the facility includes excavated areas with light-toned mounded material and scattered vegetation. The aerial photograph analysis identifies this area as part of the pond dredge area. According to the analysis, the volume of light-toned mounded material increased through 1993 and dark-toned mounded material also appears. In 1994 and 1995, light-toned mounded material and mounded material covered with scattered vegetation are observed. By 1998, the excavation is filled with material and remained undisturbed through 2005.[1]

Radionuclides of Concern: As indicated in an April 1978 incident report, two radiographers used approximately 90 Curies of Co-60, with a depleted uranium collimator at the Building 4173(4865) area.[2] Information regarding the use of the uranium collimator at the Building 4173(4865) area has not been located in available historical documents. As a result, the

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] Vandervort, P.S., Rockwell International Internal Letter Re: Field Radiography at LMEC-Damaged Source Tube, A0066, April 25, 1978.

radionuclides of potential concern at the Building 4173(4865) area include Co-60, U-234, U-235, and U-238. All radionuclides of concern are included in the August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

Drainage Pathways: Building 4173(4865) was located at the terminus of 24th Street at the base of the hill leading to the water tanks, 4701 and 4702. The pad containing Building 4173(4865) was relatively level with a gentle downward grade to the north and east. Drainage in this area would have flowed north along 24th Street and then along L Street, and into Area III, which is also the current drainage pathway.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4173(4865) area is Class 2 because of the former use of Building 4173(4865), incident reports, aerial photograph features, and gaps in operational information regarding use of the building and surrounding areas.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.2 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4173(4865) area. As discussed above, there was a radiological incident at Building 4173(4865) involving a Co-60 radiograph source.

In addition, there have been no previous characterization studies for the Building 4173(4865) area. Therefore, additional characterization is recommended for the Building 4173(4865) area. This includes the following Building 4173(4865) areas and appurtenances:

- The footprint of the former building foundation is recommended for sampling. Limited information has been located regarding the presence of any permanent structures at the Building 4173(4865) area. In addition, aerial photographs note the possible presence of tanks at the Building 4173(4865) area.
- Drainage pathways leading from Building 4173(4865) are also recommended for sampling. The pad containing Building 4173(4865) was relatively level with a gentle downward grade to the north and east. Drainage in this area would have flowed north along 24th Street and east toward Area III.
- A trench visible in 1959 aerial photographs extends from H Street to the west, past the Building 4173(4865) area, then east-southeast toward Area III. The trench appears to originate from the access road leading to Site 4885, discussed in the HSA-8 Technical Memorandum. It is recommended this trench is included in the sampling program.

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-5D Group 3 are presented. HSA-5D Group 3 includes eleven building areas including Building 4353, Organics Reactor Development Building, the facilities associated with the hydraulic test facility, Buildings 4473, 4863, and 4873, and Building 4363, the Mechanical Component Development and Counting Building.

2.3.1 Building 4353 Area

Site Description: The Building 4353 area includes Building 4353, concrete pad 4853, a leach field, and the surrounding area on L Street. Building 4353 was a laboratory with galvanized steel walls and roof that were anchored to a concrete slab floor. The building measured approximately 1,450 square feet.[1] Figures 2.3.1a through 2.3.1d 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 4353 was approximately 1,450 square feet and was constructed in the "early 1950s."[2] However, according to a 1957-1958 progress report, construction and occupancy of Building 4353 was between July 1957 and January 1958, and the building appears fully constructed in aerial photographs in 1957.[3,4] The 1957-1958 progress report indicated that Building 4353 included 1,711 square feet of laboratory space, a 224-square foot covered dock, and 2,335-square foot concrete pad.[5] The building included a 500-gallon steel underground storage tank (UT-75) that stored diesel. The tank was removed on June 13, 2001.[6] A March 15, 1962, facility layout shows the presence of seven rooms, a pad, and dock in the southeast corner of the building (Figure 2.3.1b). The building contained five internal concrete walls of unknown thickness.[7]

As indicated above, the Building 4353 area included a leach field and a septic tank, Septic Tank 4353. According to an October 15, 2001, printout titled "Septic Tank 4353," the excavation of the septic tank and leach field at Building 4353 was performed with the oversight of a health physics technician. The printout did not provide information to indicate when the excavation occurred; however, a February 5, 2001, email regarding the pumping of contents of Septic Tank 4353, would appear to indicate the removal and excavation occurred in 2001. The printout did indicate that a health physics technician performed instrument measurements and wipe tests on the concrete septic tank, the distribution box, and the field lines leading to the leach field. The measurements and wipes are documented in the printout to have not had any detectable activity. Additionally, the printout indicates that seven soil samples were taken beneath the septic tank, the distribution box, and in the leach field for analysis for gamma emitting radionuclides. These samples were reported to have not detected any man-made radionuclides. In addition, two sludge samples were taken in the septic tank for analysis of gamma emitting radionuclides, with no man-made radionuclides being detected. However, the printout did not provide the analytical data to support these findings, but indicated this data was "attached."[8,9]

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[1] ERDA Document, LR-03026, Part 1, *Site Development Plan: 1977-1981*, June 1975.
[2] Lafflam, S.R., Rockwell International letter Re: Building 353, Area IV SSFL – Asbestos Removal, January 6, 1989.
[3] Atomics International, Facilities and Data Department, *Progress Report Fiscal Year 195 and Forecast Fiscal Year 1958*, January 1958.
[4] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[5] Atomics International, Facilities and Data Department, *Progress Report Fiscal Year 195 and Forecast Fiscal Year 1958*, January 1958.
[6] Camp Dresser & McKee Inc., *Underground Storage Tank Closure Report: UT-75, Building B/353, Santa Susana Field Laboratory*, July 12, 2001.
[7] Unknown, Building Area and Room Numbering Plan, Building 353, March 15, 1962.
[8] Unknown Author, Printout Re: Septic Tank 4353, October 15, 2001.
[9] Trippeda, Dan, Email Correspondence Re: 353-Septic Pumping, February 5, 2001.

Former Use(s): Information regarding the operations in Building 4353 is limited. The 1957-1958 progress report indicated the purpose of the building to be to provide field test facilities for the performance of organic materials testing. A June 24, 1960, Atomics International technical data record indicated that an Advanced OMR Heat Transfer Loop was located at Building 4353 to obtain information on the fouling tendencies of organic coolants. The loop was constructed of ½-inch carbon steel pipe and was comprised of a forced circulation system that moved coolant by means of a pump through an in-line filter, a pre-heater, a rotameter, test heater, temperature control valve, a cooler, and a flow control valve. Components of the system were reported to have included:[1]

1. A dump and fill tank for holding the test coolant.
2. A totally enclosed centrifugal pump of the canned rotor type manufactured by Chempump Corporation.
3. An in-line filter containing a 5-10 micron cartridge to remove particulate matter.
4. A hot-trap similar in construction to the test heater for removing film formers.
5. A trim heater for adding sensible heat to the circulating test medium.
6. A surge tank connected to the system and used to maintain system operating pressure.
7. A boiling Dowtherm reflux cooler incorporated to remove the heat generated in the test heater and subsequently transferred to the test medium, thus controlling bulk temperature.
8. Control instrumentation to maintain constant flow rate, bulk temperature, and power input to the test heater.
9. Safety devices and other protective instrumentation to insure safe loop operation during the absence of operating personnel.
10. Manual pressure control only.
11. An in-line sampler is included to obtain coolant samples.
12. Coolant replenishment tanks for compositional control.

A second loop, an OMR degasifier loop was also located in Building 4353, and was constructed to study the degasification of organic coolants. The equipment of this loop was divided into two sections that comprised the main loop and the degasification train. [2]

According to a 2003 interview, Building 4353 was constructed in 1956 as a research and development laboratory for the Organic Moderate Reactor Program. A March 15, 1962, facility layout identifies the building as an Organics Reactor Development Building.[3,4] According to a January 6, 1989, Rockwell International correspondence, Building 4353 was used for miniature solid fuels engine development.[5] Another document, a 1992 Environmental Monitoring Program Plan, indicates the building was used for sodium testing until the late 1960s.[6] Based on a August 31, 1960, incident report, the building contained a "Impurification Removal Loop" that contained 30% High Boiler (HB) coolant.[7]

[1] Huber, D.A., Atomics International Technical Data Record, *Advanced OMR, Convective Heat Transfer*, June 24, 1960.
[2] Huber, D.A., Atomics International Technical Data Record, *Advanced OMR, Convective Heat Transfer*, June 24, 1960.
[3] Personnel Interview, Dan Trippeda, September 8, 2003.
[4] Unknown, Building Area and Room Numbering Plan, Building 353, March 15, 1962.
[5] Lafflam, S.R., Rockwell International letter Re: Building 353, Area IV SSFL – Asbestos Removal, January 6, 1989.
[6] Rocketdyne, Document No. ER-AN-006, *Environmental Monitoring Program Plan Santa Susana Field Laboratory Area IV*, April 30, 1992.
[7] Atomics International, Internal Letter Re: Radiological Safety Incident Report, Building 353 Bay 3, August 31, 1960.

On February 28, 1968, an Atomics International internal letter authorized the use of Building 4353 for the storage of up to 100 pounds of "Class A explosives." According to the letter, it was required that different storage bins be used for each different class of explosive stored in the facility.[1] A September 24, 1971, Atomics International report titled "Safety Analysis Report for L-85 Nuclear Examination Reactor" indicated that some of the neutron radiography work performed at the L-85 reactor involved explosive devices. The devices included squibs, cutters, trains, initiators, shaped charges, and detonating cords. The explosives were described as being small, and designed to actuate, separate, or trigger some operations, and were not "capable of producing damage to the surroundings." The shipment, storage, and handling of explosives at the SSFL were governed by the Atomics International Explosives Safety Procedures. According to the report, Building 4353 served as a special explosives storage building to store the devices described above.[2] It is unknown how long this material was stored in Building 4353, or the quantity of the material stored during the duration of these operations. 1989 partial facility drawings identify the building as a hypersonic flow test facility.[3] Information regarding the use of the building as a hypersonic flow test facility has not been located.

The Building 4353 demolition is described in a December 2000 work plan. According to the work plan, the concrete walls of Building 4353 were to be removed and resized by an excavator. The work plan did not indicate the requirement for any surveys during the removal process. The only requirements were for the use of water mist to mitigate any lead dust from becoming airborne.[4]

The steel portion of the structure was removed in the late 1970s and the concrete pad was removed in 2001 during the removal of the septic tank.[5]

Information from Interviewees: There have been no interviews associated with the operations of Building 4353 identified, to date.

Radiological Incident Reports: There has been one documented incident associated with Building 4353 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 the incident reports are provided following the table, when available.

Building 4353 Incident Report Summary

Incident File Name	Date of Incident	Location of Incident	Isotopes	Description of Incident
A0375	7/29/1960	Bldg 353 Bay 3	Activated Corrosion Product	HB Coolant Test Loop Leak, Sprayed HB on Employee's Face and Hair[6]

[1] Ashley, R.L., Internal Letter Re: Storage of Explosives in Building 353, Santa Susana, February 28, 1968.
[2] Atomics International, Report No. AI-70-73, Revision 1, *Safety Analysis Report for L-85 Nuclear Examination Reactor*, September 24, 1971.
[3] HDMSP01714258 and HDMSP01714259
[4] Schleck, Lennie, *Lead Work Plan for Construction Project, Project Title B4363 & 4353 Demolition*, December 8, 2000.
[5] Personnel Interview, Dan Trippeda, September 8, 2003.
[6] Mandel, H., *Heavy Water Organic Cooled Reactor, Physical Properties of Some Polyphenyl Coolants*, April 15, 1966.

- On July 29, 1960, while inspecting a hissing noise from the "Impurification Removal Loop" in Building 4353, Bay 3, an employee was exposed to 30% HB coolant from which over 90 percent of the radioactivity had been removed. A survey of the inside of the hood containing the "Impurification Removal Loop" detected contamination of 194 dpm/100 cm^2. (Incident Report A0375).[1,2]

Current Use: As indicated above, the steel portion of the structure was removed in the late 1970s.[3]

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

- **1959 Atomics International Environmental Survey.** On February 27, 1959, a special survey of the Building 4353 area was made in conjunction with a routine environmental survey of the Santa Susana area. According to the survey, Atomics International established ten sampling stations around Building 4353. The samples collected at each station consisted of young green vegetation, and alluvial soil from "dry rivulets remaining from recent rainfall." Atomics International presented that the activity levels were comparable with the routine survey of the Santa Susana area, with no apparent localized activity increase. Figure 2.3.1d provides a view of the sampling locations and the analytical results. The source document did not provide the methods used for analysis.[4]

- **1959 Atomics International Radiological Survey.** A radiological survey of the surrounding grounds was conducted in 1959. There was no evidence suggesting an incident was causal for this survey. The release levels from this survey range from 32.0 to 527.5 dpm/cm^2, below the 1,000 dpm/cm^2 limit.[5]

- **1976 Atomics International Soil Sampling.** According to an Atomics International 1976 environmental monitoring and facility effluent annual report, Atomics International personnel collected several soil samples on December 14, 1976, near the Nuclear Materials Development Facility, Building 4055, for analysis of Pu-238 and total Pu-239 plus Pu-240. The analysis of the sample was performed by the Health Services Laboratory of ERDA, Idaho Falls, Idaho. According to the report, a sample was taken south of Building 4353, on the south side of L Street, approximately 700 feet southeast of the Building 4055 stack exhaust.[6] The annual report noted the Pu-238 concentration to be $(0.23 \pm 0.09) \times 10^{-8}$ µCi/g, and the Pu-239 plus Pu-240 concentration to be $(1.2 \pm 0.2) \times 10^{-8}$ µCi/g.[7]

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[1] Atomics International, Internal Letter Re: Radiological Safety Incident Report, Building 353 Bay 3, August 31, 1960.
[2] The location of Bay 3 within Building 4353 could not be identified in available documents and facility drawings. The only available facility layout of Building 4353 is dated March 15, 1962, and does not identify any areas of the building as Bay 3.
[3] Personnel Interview, Dan Trippeda, September 8, 2003.
[4] Moore, J.D., Inter-Office Letter Re: Environmental Survey of Building 353 Area, April 21, 1959.
[5] Atomics International Internal Document, no document number, *Special Survey of Building 353 Area*.
[6] The report did not indicate the distance south of Building 4353.
[7] Atomics International, Document No. AI-77-14, *Environmental Monitoring and Facility Effluent Annual Report 1976*, Undated.

According to the 1978 annual environmental monitoring and facility effluent reports, Building 4353 served as sample station, S-58, for monthly soil sampling to determine the "concentrations of radioactivity" and semiannual soil sampling for plutonium analysis. Sampling at S-58 appears to have been conducted through 1989. A summary of the available survey results of the soil plutonium radioactivity data is presented in the table below: [1,2,3,4,5,6,7,8,9,10,11]

[1] Rockwell International, Report No. ESG-79-7, *Environmental Monitoring and Facility Effluent Annual Report 1978*, April 1979.
[2] Rockwell International, Report No. ESG-81-17, *Environmental Monitoring and Facility Effluent Annual Report 1980*, May 27, 1981.
[3] Rockwell International, Report No. ESG-82-21, *Environmental Monitoring and Facility Effluent Annual Report 1981*, July 15, 1982.
[4] Rockwell International, Report No. ESG-83-17, *Environmental Monitoring and Facility Effluent Annual Report 1982*, June 1983.
[5] Rockwell International, Report No. ESG-84-9, *Environmental Monitoring and Facility Effluent Annual Report 1983*, March 1984.
[6] Rockwell International, Report No. RI/RD85-123, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1984*, March 1985.
[7] Rockwell International, Report No. RI/RD86-140, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1985*,April 1986.
[8] Rockwell International, Report No. RI/RD87-133, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1986*, March 1987.
[9] Rockwell International, Report No. RI/RD88-144, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1987*, March 1988.
[10] Rockwell International, Report No. RI/RD89-139, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1988*, May 1989.
[11] Rockwell International, Report No. RI/RD90-132, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1989*, May 1990.

S-58 (Building 4353) Soil Plutonium Radioactivity Data

Date	Pu-238	Pu-239 + Pu-240
June 8, 1978	(-3.59 ± 2.3) x 10^{-9} μCi/g	(1.46 ± 3.0) x 10^{-9} μCi/g
December 13, 1978	*	(5.54 ± 2.8) x 10^{-9} μCi/g
July 9, 1980	(-0.2 ± 2.4) x 10^{-9} μCi/g	(1.6 ± 2.0) x 10^{-9} μCi/g
December 22, 1980	(0.4 ± 3.1) x 10^{-9} μCi/g	(9.9 ± 4.6) x 10^{-9} μCi/g
July 8, 1981	(-2.2 ± 2.0) x 10^{-9} μCi/g	(4.2 ± 2.7) x 10^{-9} μCi/g
December 17, 1981	(-3.6 ± 0.8) x 10^{-9} μCi/g	(0.3 ± 1.4) x 10^{-9} μCi/g
July 9, 1982	(-3.2 ± 1.2) x 10^{-9} μCi/g	(7.1 ± 2.3) x 10^{-9} μCi/g
December 16, 1982	(0.8 ± 2.9) x 10^{-9} μCi/g	(7.3 ± 2.8) x 10^{-9} μCi/g
June 22, 1983	(1.5 ± 4.3) x 10^{-9} μCi/g	(10.6 ± 8.6) x 10^{-9} μCi/g
December 7, 1983	(0.2 ± 0.5) x 10^{-9} μCi/g	(4.3 ± 2.1) x 10^{-9} μCi/g
June 25, 1984	(0.1 ± 0.1) x 10^{-9} μCi/g	(2.9 ± 0.4) x 10^{-9} μCi/g
December 4, 1984	(0.1 ± 0.1) x 10^{-9} μCi/g	(3.6 ± 0.6) x 10^{-9} μCi/g
June 26, 1985	0.0001 ± 0.0001 pCi/g	0.002 ± 0.0004 pCi/g
December 4, 1985	0 ± 0.0001 pCi/g	0.0048 ± 0.0006 pCi/g
June 25, 1986	0.0003 ± 0.0003 pCi/g	0.0031 ± 0.0009 pCi/g
December 8, 1986	0.003 ± 0.0002 pCi/g	0.0032 ± 0.0006 pCi/g
June 22, 1987	0.0002 ± 0.0001 pCi/g	0.0022 ± 0.0003 pCi/g
December 7, 1987	0.0032 ± 0.0007 pCi/g	0.0071 ± 0.0010 pCi/g
June 29, 1988	0.0004 ± 0.0001 pCi/g	0.0022 ± 0.0003 pCi/g
December 1, 1988	0 ± 0.0001 pCi/g	0.0033 ± 0.0004 pCi/g
July 19, 1989	0.0001 ± 0.0001 pCi/g	0.0025 ± 0.0003 pCi/g
December 5, 1989	0.0002 ± 0.0002 pCi/g	0.0042 ± 0.0005 pCi/g

Minus (-) indicates sample value less than reagent blank.
*Results significantly less than the minimum detection level.

As indicated above, these measurements appear to have ceased in 1989 and were replaced with annual exposure rates monitored on site with calcium sulfate dosimeters that were provided by the Radiologic Health Branch of the State of California Department of Health Services. These dosimeters, according to a 1990 annual report, provided independent monitoring of radiation levels at the SSFL. The dosimeters were reported to have been returned to the RHB for evaluation by an RHB vendor laboratory. SS-6, located at the northeast corner of Building 4353, was sampled quarterly. The results of these surveys are presented in the table below:[1,2,3,4,5,6,7,8]

[1] Rockwell International, Report No. RI/RD91-136, *Environmental Monitoring Annual Report Santa Susana Field Laboratory, De Soto, and Canoga Sites 1990*, June 20, 1991.
[2] Rockwell International, Report No. RI/RD92-138, *Environmental Monitoring Annual Report Santa Susana Field Laboratory and De Soto Sites 1991*, September 30, 1992.
[3] Rockwell International, Report No. RI/RD93-125, *Environmental Monitoring Annual Report Santa Susana Field Laboratory and De Soto Sites 1992*, December 14, 1993.
[4] Rockwell International, Report No. RI/RD94-126, *Annual Site Environmental Report Santa Susana Field Laboratory and De Soto Sites 1993*, October 21, 1994.
[5] Rockwell International, Report No. RI/RD95-153, *Annual Site Environmental Report Santa Susana Field Laboratory and De Soto Sites 1994*, September 30, 1995.
[6] Rockwell International, Report No. RI/RD96-140, *Annual Site Environmental Report Santa Susana Field Laboratory and De Soto Sites 1995*, Date Unknown.
[7] Boeing, Report No. RD97-134, *Rocketdyne Propulsion & Power DOE Operations Annual Site Environmental Report 1996*, November 10, 1997.
[8] Boeing, Report No. A4CM-ZR-0012, *Rocketdyne Propulsion & Power DOE Operations Annual Site Environmental Report 1997*, November 23, 1998.

SS-6 (Building 4353) Ambient Radiation Dosimetry Data

Year	Quarterly Exposure (mrem)				Annual Exposure (mrem)	Annual Average Exposure Rate (μR/hr)	
	1st	2nd	3rd	4th		Rocketdyne	State DHS
1990	10.0	10.0	15.0	10.0	45.0	5.1	11.7
1991	10.0	30.0	30.0	10.0	80.0	9.1	12.0
1992	10.0	15.0	30.0	10.0	65.0	7.4	11.9
1993	20.0	15.0	10.0	10.0	55.0	6.3	10.6
1994	33.0	33.0	33.0	33.0	132.0	15.1	12.7
1995	46.2	46.2	41.3	55.2	188.8	21.5	12.9
1996	26.3	26.3	21.5	35.4	109.6	12.5	12.9
1997	27.8	27.1	26.9	23.8	105.6	12.0	12.4

- **1994-1995 Area IV Radiological Characterization Survey**. According to the Area IV Radiological Characterization Survey, Building 4353 area was included in the survey conducted in 1994 and 1995. Located in northern portion of survey block G14, the Building 4353 area ambient gamma survey results measured between 11.3 and 17.0 μR/hr. The Rocketdyne survey found background to be 15.6 μR/hr, and the acceptable limit was identified as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Building 4353 area were found to be below the then-acceptable limits. In addition to the ambient gamma survey, the 1996 characterization also included soil sampling in the vicinity of Building 4353. This included one 6-inch soil sample taken along the L Street drainage channel south of Building 4353. According to the report, none of the measurements were distinguishable from background and all the measurements were below the acceptable concentration levels established by Boeing and presented in the 1999 Approved Sitewide Release Criteria for Remediation of Radiological Facilities at the SSFL.[1],[2]

- **2001 Boeing Radiological Survey of Septic Tank, Piping, and Leach Fields.** The 2005 HSA documented the results of the radiological survey of the septic tank and associated pipes and leach field discussed above that was conducted in 2001 during the removal process. According to the 2005 HSA, with two exceptions, the results were below minimum detectable activity (MDA) for both removable alpha and beta (alpha range 9-11 dpm/ cm^2, beta 18-20 dpm/ cm^2). One sample on the outside of the tank registered a level of beta 20 dpm/ cm^2, the MDA for the sample. The second exception was the clay field pipes and distribution box. These samples also registered an MDA result of 11dpm/ cm^2 alpha, 18dpm/ cm^2 beta. Direct frisk tests were performed on all samples as well with a consistent no detectable activity (NDA) result.[3]

Radiological Use Authorizations: There are no known radiological use authorizations associated with the operations in Building 4353.

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[1] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.
[2] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.
[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. Citing Boeing Internal Document, no document number, *Radiation Survey, Building 353*.

Former Radiological Burial or Disposal Locations: The building was connected to a septic tank measuring approximately 60 by 54 by 96 inches with a capacity of 1,500 gallons. There was an associated 200-foot leach field located 50 feet directly east of the northeast corner of the building.[1]

Aerial Photographs: In 1952, the area comprising the future Building 4353 area is agricultural land. By 1957, the area has been developed and Building 4353 has been constructed. In 1959, outside storage appears south of Building 4353 south of L Street. The future location of Building 4854 is under constructions to the east of the building. A linear ground scar appears in 1959 and remains visible in 1962 leading from the north end of the building to a point northwest at the southern boundary of J Street. The outside storage south of L Street is no longer visible in 1962. By 1965, two small linear structures are located at the northeast corner of the building and the linear ground scar remains visible. In 1967, the linear ground scar is more defined and a parking area appears to have been constructed south of L Street. The site remains relatively unchanged in 1972; however, the linear ground scar is less defined. In 1978, the linear ground scar is no longer visible, but a newly defined drainage channel appears to be present north of the Building 4353 area. The drainage channel is no longer obvious in 1980 aerial photographs and the immediate area surrounding the buildings appears to becoming vegetated. The site remains relatively unchanged until 1995 when the building is no longer present. The original building foundation remains, but the above-grade structure has been removed. An access road connects the former building location northward to J Street. In 2005, ground scarring is visible where the former building was located. The 2005 aerial photograph appears to show the building foundation to have been removed; however, light-toned material that appears to be concrete rubble remains visible in the northwest corner of the former building location.[2]

Radionuclides of Concern: Based on the limited available information regarding the Building 4353 operations, the radionuclides of concern cannot be defined for this facility based on actual building operations. Based on the single incident report discussed above, it appears the building may have contained some quantities of activation corrosion products and HB. Based on information received from Boeing in January 2011, activation products typically include Co-60, Mn-54, Ni-59, Ni-63, and Fe-55.[3] All radionuclides of concern are included in the EPA August 2010 Final Field Sampling Plan for soil sampling in Area IV. Table 3.3 presents a summary of radionuclides of concern.

Drainage Pathways: Based on a 1964 plot plan of the Building 4353 area, it appears the drainage pathways surrounding Building 4353 were along L Street, to the east, toward Area III. A 1978 aerial photograph shows a drainage channel to the east immediately north of the building.[4,5] Currently, the surface water run-off from the former Building 4353 area flows to the southeast then east, into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4353 area is Class 1 because of the building's previous use, apparent radiological use, and incident report.

[1] Boeing Data Package, no document number, *Septic and Leachfield Survey Data 011, 353, and 373*.
[2] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[3] Rutherford, Phil, Email Correspondence to Craig Cooper (EPA), January 4, 2011.
[4] Atomics International, Drawing 303-GEN-C-42, Santa Susana Facility Plot Plan, Sheet 8 of 14, 1964.
[5] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4353 area. As discussed above, there were radiological incidents involving activation corrosion products at Building 4353 and documented evidence of radiological releases. Significant information is lacking regarding the demolition of Building 4353 and the building's associated septic tank and leach field.

In addition, previous characterization studies for the Building 4353 area were focused on delineating the extent of contamination to standards that were applicable at the time. Additionally, characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4353 area. This includes the following Building 4353 areas and appurtenances:

- Sampling is recommended at the former Building 4353 footprint. An incident report dated July 29, 1960, indicated that an employee was exposed to 30% HB coolant from which over 90 percent of the radioactivity had been removed. A survey of the inside of the hood containing the "Impurification Removal Loop" detected contamination of 194 dpm/100 cm^2.[1,2] Limited information regarding these type of operations has been located.
- As indicated above, the building was connected to a 1,500-gallon septic tank and an associated 200-foot leach field located 50 feet directly east of the northeast corner of the building. Sampling is recommended at the former leach field and septic tank locations[3]
- The drainage channel located northeast of the Building 4353 area and drainage channels along K Street. Should radioactive materials have drained from facilities associated with Building 4353 to the east-southeast, residual contamination not consistent with the DTSC/DOE December 2010 AOC may exist.

2.3.2 Parking Lot 4553 Area

Site Description: The Parking Lot 4553 area comprises the parking lot near Buildings 4353 and 4854, and the surrounding area. This area is located just north of L Street. This area is never identified as an established parking lot in any of the available industrial planning maps. The 2005 HSA identified Parking Lot 4553 as a site investigation area, and as a result, it has been included in this TM. Figure 2.3.2a provides a current photograph. Drawings specific to Parking Lot 4553 could not be located. Plate 1 presents a summary of all identified features for this site.

Building Features: There are no building features to report for Parking Lot 4553. There is limited information available to indicate when this parking lot was constructed. As indicated above, available industrial planning maps do not identify this area as an established parking lot.

[1] Atomics International, Internal Letter Re: Radiological Safety Incident Report, Building 353 Bay 3, August 31, 1960.
[2] The location of Bay 3 within Building 4353 could not be determined based on available documents or facility drawings. The only available facility layout of Building 4353 is dated March 15, 1962, and does not identify any areas of the building as Bay 3.
[3] Boeing Data Package, no document number, *Septic and Leachfield Survey Data 011, 353, and 373*.

As a result, it is uncertain whether this area was paved. The area identified by the 2005 HSA as Parking Lot 4553 is located between Building 4353, discussed above, and Building 4854, discussed below.[1]

Former Use(s): Parking Lot 4553 appears to have been mainly used for its intended purpose of serving personnel working in Buildings 4353 and 4854.[2]

Information from Interviewees: None to date.

Radiological Incident Reports: There have been no incident reports associated with operations at Parking Lot 4553 identified to date.

Current Use: Based on aerial photographs, the area comprising the former Parking Lot 4553 area appears to be graded. An unpaved roadway extends from J Street and makes a loop around the former Building 4854 location.[3]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Parking Lot 4553 have not been conducted; however, according to the Area IV Radiological Characterization Survey, the area was included in the survey conducted in 1994 and 1995. Also located in northern portion of survey block G14 with Building 4353, the Parking Lot 4553 area ambient gamma survey results measured between 11.3 and 17.0 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Parking Lot 4553 area were found to be below the then-acceptable limits.[4,5]

Radiological Use Authorizations: None.

Former Radiological Burial or Disposal Locations: None.

Aerial Photographs: In 1952, the area comprising the Parking Lot 4553 area is agricultural land. By 1957, the area has been developed and Building 4353 has been constructed, and a graded area is visible to the east of the building. In 1959, outside storage appears south of the Parking Lot 4553 area, south of L Street. The future location of Building 4854 is under constructions to the east of the parking lot. In 1965, two unidentified linear structures are visible to the north of the Parking Lot 4553 area. In 1967, the two linear structures are no longer present, and a parking area appears to have been constructed south of L Street; however this is not confirmed in industrial planning maps. The site remains relatively unchanged in 1972. In 1978, a newly defined drainage channel appears to be present north of the Parking Lot 4553 area. The drainage channel is no longer obvious in 1980 aerial photographs and the Parking Lot 4553 appears to becoming vegetated. The site remains relatively unchanged until 1995 when Building 4353 is no longer present. An access road connects the former building and parking lot 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.
[2] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[3] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[4] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.
[5] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.

northward to J Street. In 2005, ground scarring is visible where Building 4353 and Parking Lot 4553 were located.[1]

Radionuclides of Concern: None.

Drainage Pathways: Based on a 1964 plot plan of the Building 4353 area, including the area identified in the 2005 HSA as Parking Lot 4553, it appears the drainage pathways surrounding this area were along L Street, to the east, toward Area III. A 1978 aerial photograph also shows a drainage channel to the east immediately north of the Parking Lot 4553 area.[2,3] Currently, the surface water run-off from the former Building 4353 area drains to the southeast then east, into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Parking Lot 4553 area is Class 3 because of the parking lots use for intended purposes and no evidence of any outside storage activities at or near Parking Lot 4553.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Parking Lot 4553 area. As indicated above, there were no building features to report for Parking Lot 4553. Industrial planning maps do not show an established parking area in the vicinity, and as a result, it is uncertain whether this area was paved.

In addition, there have been no previous characterization studies for the Parking Lot 4553 area. Therefore, additional characterization is recommended for the Parking Lot 4553 area. This includes the following areas and appurtenances:

- The perimeter of the former Parking Lot 4553, including the drainage channel located northeast of the parking lot. Should radioactive materials have drained from facilities associated with Building 4353 to the east to the parking lot, residual contamination not consistent with the DTSC/DOE December 2010 AOC may exist along the northeast perimeter of the former Parking Lot 4553.

2.3.3 Building 4854 Area

Site Description: The Building 4854 area includes Building 4854 and the surrounding area. Building 4854, the radiation gauge test structure, was a single building owned by the U.S. Navy. It was located to the east of Building 4353, discussed above, just north of L Street along the Area IV eastern border. The building first appears in 1959 aerial photographs as a probable construction area and is visible in the 1962/1963 photos.[4] Figure 2.3.3a provides a current photograph of the former building location and Figure 2.3.3b provides a plot plan of the building. To date, the research team has not located any drawings of the Building 4854 layout.

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] Atomics International, Drawing 303-GEN-C-42, Santa Susana Facility Plot Plan, Sheet 8 of 14, 1964.
[3] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[4] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

Building Features: Information regarding the features of Building 4854 could not be located in available documents. A 1969 plot plan shows the location of the building, but does not show any utility connections to or from the building (see Figure 2.3.3b).[1]

Former Use(s): Based on industrial planning maps, Building 4854 was a U.S. Navy-owned building. The building first appears in 1959 aerial photographs as a probable construction area and is visible in the 1962/1963 photos. The building remains visible through 1983 and appears to have been removed some time between 1983 and 1988. Industrial planning maps identify the building as a radiation gauge test structure. According to the 2005 HSA, the building was used to test radiation fuel gauges, although it is unknown the source of this information. The building is referenced in numerous annual environmental monitoring reports as having included a thermo luminescent dosimeter (TLD) location. These are discussed below. [2,3,4]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.

Current Use: Based on aerial photographs, and as indicated above, the building appears to have been demolished sometime between 1983 and 1988. The former location of the Building 4854 area is currently vegetated.[5]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): As indicated above, Building 4854 is referenced in numerous annual environmental monitoring reports as having included a TLD sampling location. In the 1973 annual environmental monitoring report, the TLD location for Building 4854 is identified as TLD-10 and appears to be located at the southeast corner of the building. By 1978, the TLD location was renumbered to TLD-6 and in 1985 was renumbered again to SS-6. 1976 is the first year that ambient radiation dosimetry data is presented in the available annual reports. The data presented in the annual reports initially included only the average dose rate for the year each quarterly measurement was taken. Beginning in 1981, the annual reports included the data for each quarter's measurements. A summary of the available TLD data is presented in the table below.[6,7,8,9,10,11,12,1,2,3,4,5,6,7]

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[1] Atomics International, Drawing 303-GEN-C-42, Santa Susana Facility Plot Plan, Sheet 8 of 14, 1964.
[2] Atomics International, Industrial Planning Map Nuclear Development Field Laboratories, May 1972.
[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.
[4] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[5] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[6] Moore, J.D., *Environmental and Radioactive Effluent Monitoring Annual Report 1973*, Undated.
[7] Rockwell International, Document No. AI-76-21, *Environmental Impact Assessment of Operations at Atomics International Under Special Nuclear Materials License No. SNM-21*, April 30, 1976.
[8] Moore, J.D., Document No. AI-77-14, *Atomics International Environmental Monitoring and Facility Effluent Annual Report 1976*, Undated.
[9] Moore, J.D., Document No. ESG-79-7, *Energy Systems Group Environmental Monitoring and Facility Effluent Annual Report 1978*, April 1979.
[10] Moore, J.D., Document No. ESG-81-17, *Energy Systems Group Environmental Monitoring and Facility Effluent Annual Report 1980*, May 27, 1981.
[11] Moore, J.D., Document No. ESG-82-21, *Energy Systems Group Environmental Monitoring and Facility Effluent Annual Report 1981*, July 15, 1982.
[12] Moore, J.D., Document No. ESG-83-17, *Energy Systems Group Environmental Monitoring and Facility Effluent Annual Report 1982*, June 1983.

Beginning in 1990, the SS-6 sampling station is identified as being at the northeast corner of Building 4353. As a result, the results for the SS-6 ambient radiation dosimetry data after 1989 are presented above in Section 2.3.1.

TLD-10/TLD-6/SS-6 (Building 4854) Ambient Radiation Dosimetry Data

Year	Quarterly Exposure (mR)				Average Dose Rate (mR/hr)	Annual Exposure (mR)	Equivalent Exposure at 1,000 feet above sea level	
	1st	2nd	3rd	4th			mR	μR/hr
1973*	NR	NR	NR	NR	0.012	NR	105	NR
1974*	NR	NR	NR	NR	0.013	NR	114	NR
1975*	NR	NR	NR	NR	0.011	NR	96	NR
1976	NR	NR	NR	NR	0.010	NR	89	NR
1978	NR	NR	NR	NR	0.016	NR	140	NR
1980	NR	NR	NR	NR	0.018	NR	158	NR
1981	37	31	30	39	NR	137	NR	16
1982	25	27	28	28	NR	108	NR	12
1983	26	27	29	26	NR	108	97	11
1984	**	34	22	22	NR	104	93	11
1985	26	37	30	32	NR	125	114	13
1986	23	32	36	31	NR	122	111	13
1987***	30	54	38	32	NR	154	143	16
1988	25	19	29	21	NR	94	82	9
1989****	23	23	42	20	NR	108	NR	12.3

NR= not reported
*The data from the 1973, 1974, and 1975 dosimetry readings was not presented in annual environmental monitoring reports, but rather a 1976 environmental impact assessment.
**Dosimeter was missing and annual exposure based on data for three quarters.
***According to the 1987 report, the TLD exposure data was higher than expected during the second, third, and fourth quarters for the on-site and the off-site dosimeters. No specific causes were identified and because the higher results were noted for the on- and off-site dosimeters, the report attributed the values to "an intermittent bias in the dosimeter readout instrumentation."
****Similar to the results in 1987, the 1989 report indicated the TLD exposure data was higher than expected during the third quarter of 1989 for both on- and off-site locations.

Based on the annual environmental reports, the TLD data was used to compare the radiation dose rates and equivalent annual doses monitored at the SSFL with three widely separated off-site locations. The data included "the natural background radiation component which exists as a consequence of cosmic radiation, radionuclides in the soil, and radon and thoron in the atmosphere, in addition to radiation fallout from nuclear weapons tests." According to the 1978 report, this level ranged yearly from approximately 100 to 150 mrem/year locally. For the available data presented in the annual reports, the reports summarized that there were "no

[1] Moore, J.D., Document No.ESG-84-9, *Energy Systems Group Environmental Monitoring and Facility Effluent Annual Report 1983*, March 1984.
[2] Moore, J.D., Document No. RI/RD85-123, *Rocketdyne Division Environmental Monitoring and Facility Effluent Annual Report 1984*, March 1985.
[3] Moore, J.D., Document No. RI/RD86-140, *Rocketdyne Division Environmental Monitoring and Facility Effluent Annual Report 1985*, April 1986.
[4] Moore, J.D., Document No. RI/RD87-133, *Rocketdyne Division Environmental Monitoring and Facility Effluent Annual Report 1986*, March 1987.
[5] Moore, J.D., Document No. RI/RD88-144, *Rocketdyne Division Environmental Monitoring and Facility Effluent Annual Report 1987*, March 1988.
[6] Moore, J.D., Document No. RI/RD89-139, *Rocketdyne Division Environmental Monitoring and Facility Effluent Annual Report 1988*, May 1989.
[7] Moore, J.D., Document No. RI/RD90-132, *Rocketdyne Division Environmental Monitoring and Facility Effluent Annual Report 1989*, May 1990.

measureable radiation doses to the general population or to individuals in uncontrolled areas" resulting from operations in Area IV.

Radiological Use Authorizations: None found.

Former Radiological Burial or Disposal Locations: None.

Aerial Photographs: In 1952, the area comprising the future Building 4854 area is agricultural land. By 1957, the area has been developed and Building 4353 has been constructed to the west of the future Building 4854 location. In 1959, outside storage appears south of Building 4854 south of L Street. The future location of Building 4854 is under constructions. The outside storage south of L Street is no longer visible in 1962. By 1965, two small linear structures are located north of the building. The site remains relatively unchanged in 1972. In 1978, a newly defined drainage channel appears to be present north of the Building 4854 area and appears to flow southeast toward Area III. The drainage channel is no longer obvious in 1980 aerial photographs and the immediate area surrounding the buildings appears to becoming vegetated. A ground scar is visible at the northwest corner of the building. In 1983 the site appears to be less active as a result of increased vegetation surrounding the area and by 1988 the building is no longer visible. In 1988, directly east of the former building, in Area III, a large area of medium-toned mounded material is visible. Similar medium-toned mounded material is visible south of the Building 4854 area along the Area IV and Area III border. In 2005 the area is most vegetated with a ground scar showing the former locations of both Building 4854 and 4353.[1]

Radionuclides of Concern: Given the limited information available regarding the operations of this building, there are no radionuclides of concern associated with the Building 4854 building operations. However, it is likely that numerous gauges and other instruments possibly containing radium dials were used at this building.

Drainage Pathways: Aerial photographs show the presence of at least two drainage channels at or near Building 4854. One drainage channel extends from the southeast corner of the building to the southeast and into Area III. Another drainage channel, clearly visible in 1978 aerial photographs extends past Building 4854 from the northwest to the southeast into Area III. A 2007 site map identifies two drainage channels in this approximate area as "Drainage 6." [2,3] Currently, only the drainage that extended from the southeast corner of the building in present.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4854 area is Class 2 because of the unknown nature of the operations conducted in Building 4854 by the U.S. Navy, and because of the building's close proximity to Building 4353.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4854 area. Significant information is lacking regarding the operations of Building 4854.

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[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[3] Montgomery Watson Harza, *Group 8 – Western Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California, Volume I – Text, Tables, and Figures*, September 2007, pp. 2-6 - 2-8.

In addition, there have been no previous characterization studies for the Building 4854 area. Therefore, additional characterization is recommended for the Building 4854 area. This includes the following Building 4854 areas and appurtenances:

- The former Building 4854 footprint. As indicated above, Building 4854 was a U.S. Navy-owned building. The building first appears in 1959 aerial photographs as a probable construction area and is visible in the 1962/1963 photos. The building remains visible through 1983 and appears to have been removed some time between 1983 and 1988.
- The drainage channel located southeast of the Building 4854 area along L Street. Should the building have been involved with the use or storage of radioactive materials and the radioactive materials drained from the building to the southeast, residual contamination not consistent with the DTSC/DOE December 2010 AOC may exist along these drainage channels. The storage and use of radioactive materials in Building 4854 could not be determined from available historical documents.

2.3.4 Building 4363 Area

Site Description: The Building 4363 area includes Building 4363, parking lot 4573 (1981 to 1992), and the surrounding area just north of L Street and east of 24th Street. Building 4363 was constructed between October 1957 and January 1958, and was located in an area identified in plot plans as the "SETF area." [1] The building was a 1,400-square foot structure with four work bays. Figures 2.4.5a through 2.4.5f 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 4363 was a 1,400-square-foot structure with four work bays (240 square feet each) placed side by side, a rest room, a small utility room, and an "experimental neutron physics" room on the eastern half of the building. Each bay had double-door access at both the front and back ends of the rooms, and measured approximately 240 square feet. Concrete walls separated the bays with no direct access from one bay to the other. The north and south walls were sheet metal with partial wall panels on the inside wall surfaces. The roof was constructed from composition panels with asphalt base topping. The building sat on a concrete foundation that extended around the building to form a perimeter walkway and loading dock. Building 4363 had an associated leach field measuring 100 by 4 by 3 feet with a septic tank capacity of 1,500 gallons.[2,3,4,5]

According to a 1964 plot plan, the northeast corner of the building was connected to a 6-inch vitrified clay sanitary sewer pipe. The building received water through a 6-inch pipe and also provided water to Building 4375.[6] Prior to this connection to the sanitary sewer system,

[1] Atomics International, Facilities and Data Department, *Progress Report Fiscal Year 195 and Forecast Fiscal Year 1958*, January 1958.
[2] Rocketdyne Report, 363-AR-0001, *Decontamination and Decommissioning of Building T363*, September 25, 1997.
[3] Atomics International, Drawing 303-363-A3, *Floor Plans & Details, Building 363 Remodel*, Date illegible.
[4] Atomics International, Drawing 303-363-P3, *Water Line Location – Bldg 363 – Fire Protection Modification*, October 7, 1957.
[5] Rocketdyne, Report No. SSWA-ZR-0002, *Final Radiological Survey Report for Building T363*, June 21, 1996.
[6] Atomics International, Drawing 303-GEN-C-42, Santa Susana Facility Plot Plan, Sheet 8 of 14, 1964.

Building 4363 had an associated leach field to the north of the building. The Building 4363 leach field had an associated sampling location in the 1992 environmental monitoring program plan, which identified the leach field as a RCRA area of concern location.[1]

Former Use(s): Limited operational information for Building 4363 has been located. According to a 1957 and 1958 progress report, the facility was referred to as a mechanical component development and counting room and was designed to provide field test facilities for the performance of OMR mechanical component development tests.[2] Numerous documents indicate that Building 4363 was transferred from the Rocketdyne Division to the Atomics International between 1956 and 1957 to support expansion of the Atomics International activities at the SSFL. It is unknown how Rocketdyne utilized the building prior to the transfer to Atomics International; however, 1957 drawings appear to show the building was modified prior to Atomics International use of the building. The modification included the addition of parking to the east of the building, and a modification to the building's drainage system.

A June 24, 1960, Atomics International technical data record indicated that a Piqua heat transfer loop was located at Building 4363 to obtain data on the heat transfer characteristics of organic fluids over a wide range of Reynolds and Prandtl numbers for various fuel elements and fuel element surface configurations. The major components of the loop included:[3]

1. A drain tank for holding the test coolant
2. A centrifugal pump for circulating the test coolant capable of producing a flow rate of 150 GPM against a 120 foot head
3. 3-inch carbon steel pipe with ring joint flange connections
4. A 10 KW immersion heater
5. A turbine flow meter to measure coolant flow rate
6. Various test section configurations
7. A surge tank for maintaining system pressure by the admission of nitrogen gas
8. An air cooled Dowtherm heat exchanger to remove the heat generated in the test section, controlling bulk temperature
9. In-line filters containing elements of 2 to 12 micron, 10 to 25 micron, and 70 microns in size
10. A 60 KVA, a.c., poer shource for heating the fuel element heater sections.

In addition, a 1969 as-built electrical wiring construction drawing noted the presence of an OMR heat transfer loop within Building 4363.[4]

In September 1994, R.J. Tuttle conducted a study of the possible source of radioactive contamination in Bay 4 of Building 4363. In the study, Mr. Tuttle summarized surveys from 1992 and 1993 that showed spotty contamination within Bay 4 in Building 4363 consisting of Cs-137, uranium, and Sr-90. Mr. Tuttle reviewed the survey information, and site records to attempt to determine the possible source of the contamination. According to Mr. Tuttle, the Mechanical Component Development and Counting Building was used for sodium systems in

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[1] Rocketdyne, Report ER-AN-0006, *Environmental Monitoring Program Plan, Santa Susana Field Laboratory, Area IV*, September 30, 1992.
[2] Atomics International, Facilities and Data Department, *Progress Report Fiscal Year 195 and Forecast Fiscal Year 1958*, January 1958.
[3] Huber, D.A., Atomics International Technical Data Record, *Advanced OMR, Convective Heat Transfer*, June 24, 1960.
[4] Atomics International Drawing No. 303-363-E6, Electrical Plan – OMR Heat Trans. Loop – Bldg 363, Santa Susana, February 17, 1969.

support of the Sodium Reactor Experiment (SRE) from before 1959 until 1963. Mr. Tuttle summarized that the "counting" part in the name of the building may have "referred to a radioactivity counting room" that may have been moved from the Engineering Test Building Annex in 1957. According to Mr. Tuttle:[1]

> My suspicion is that some work was done on a valve or pump that contained some small amount of the directly contaminated sodium coolant, in 1962, based on dosimetry of two people assigned to that building. The total amount of activity in the measured contamination spots at present is about 0.1 µCi, or about 0.2 µCi in 1962. If this were inside a valve or pump, it would not have been detected by a portable instrument survey at the time.

A review of the termination of film badges led Mr. Tuttle to believe that the building was no longer active "much after 1963." Since 1963, Mr. Tuttle surmised that Building 4363 had been used primarily for storage.[2]

However, historical documents appear to indicate that operations involving radioactive materials may have continued beyond 1963 in Building 4363. According to an Atomics International internal letter, on May 3, 1965, Building 4363 received "three moderator can samples" from the SRE to be "potted." According to the letter, one of the samples had a beta gamma dose rate of 17.0 rad/hr, and a gamma dose rate of 3.0 r/hr, and, as a result, should not be handled at Building 4363. The letter stated that the samples were warmer than any others that had been handled in Building 4363 in "quite a while," and "contamination during polishing may be more of a problem."[3] As a follow up to this letter, a June 3, 1965, Atomics International internal letter provided that materials that have a surface gamma dose rate of 200 mr/hr or less gamma, and 2 rad/hr or less beta gamma, could be handled in Building 4363 with no special precautions. The letter further stated that "no materials will be handled in Building 363 if the surface dose rates exceed 1 r/hr (gamma) or 10 rad/hr (beta gamma).[4] Additional information regarding the nature or duration of these operations in Building 4363 could not be located in the documents obtained to date.

A July 1965 nuclear operations technical progress report indicated that tests designed to detect possible vibration in a simulated bundle of fuel rods was conducted in the hydraulic test loop in Building 4363. The experiments used "specially designed conductivity cells as vibration sensors."[5]

In April 1992, during the removal of materials being stored in Building 4363, Rocketdyne personnel found fixed beta contamination in Bay 4 of the building. Rocketdyne performed a more detailed radiological survey of Building 4363 in April 1993, confirming the presence of contamination in Bay 4. In May 1995, Rocketdyne completed a radiological assessment report

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[1] Tuttle, R.J., Internal Letter Re: Study of Possible Source of Radioactive Contamination in T363, September 9, 1994.
[2] Tuttle, R.J., Internal Letter Re: Study of Possible Source of Radioactive Contamination in T363, September 9, 1994.
[3] Tschaeche, A.N., Internal Letter Re: Dose Rates from Moderator Can Samples from SRE at Building 363, May 5, 1965.
[4] Tschaeche, A.N., Internal Letter Re: Dose Rates for Handling Materials in Building 363, June 3, 1965.
[5] Henock, W.W., *Nuclear Operations Department Technical Progress Report July 1965*, August 26, 1965.

and D&D plan for the building.[1] The D&D plan described the work plan required to decontamination and decommission Bay 4 of Building 4363 in order to release Building 4363 for demolition and removal from the SSFL. These D&D activities included those associated with the removal of electrical conduit and wire, light fixtures, piping systems, ventilation systems and ducting, wall paneling, and paint and concrete surfaces.[2]

The 1995 annual site environmental report indicated that Rocketdyne completed D&D activities at Building 4363 in 1995.[3] A decontamination effort was conducted in 1995.[4] This included the decontamination of Bay 4, including the removal of fixtures, plumbing and ducting, and decontamination of surfaces within the building. According to the D&D plan, previous radiological surveys found loose and fixed radiological contamination on the walls of Bay 4. As a result, contamination was believed to also be present under the paint. Accordingly, the paint was to be removed and the surfaces decontaminated, as necessary.[5]

According to the 2005 HSA, Building 4363 was demolished in 2001 and the sanitary leach field system was removed in 2002.[6] The demolition report for Building 4363 has not yet been obtained; however, a 2000 and 2001 addendum to the demolition contract for Building 4363, indicated that the demolition of the building included the unearthing and removal of approximately 90 feet of 6-inch sanitary sewer line, located on the northeast side of the building, to the cleanout port adjacent to Building 4363. The drain run was to be capped with concrete leaving the cleanout functional.[7,8] And similar to the demolition described above in a December 2000 work plan for Building 4353, the concrete walls of Building 4363 were to be removed and resized by an excavator. The work plan did not indicate the requirement for any surveys during the removal process. The only requirements were for the use of water mist to mitigate any lead dust from becoming airborne.[9]

Information from Interviewees: There have been no interviews conducted recently relating to the operations of Building 4363. Boeing documents included handwritten notes by an unknown author, however, that indicated a former employee recalled that SNAP components were stored in Building 4363. The employee also recalled that one of the middle rooms was set up as a lab, maybe with a fume hood.[10]

Radiological Incident Reports: A review of documented incident reports at the SSFL did not locate any incidents at Building 4363. However, according to the 1994 Area IV Radiological Characterization Plan, a small explosion occurred in the building in the late 1960s that resulted in the spread of low-level radioactive contamination throughout one room of the building. The plan

[1] Rocketdyne, Report No. SSWA-ZR-0002, *Final Radiological Survey Report for Building T363*, June 21, 1996.
[2] Pendleberry, S., ETEC Document No. SSWA-AN-0005, *D&D Plan for Building 363,* May 12, 1995.
[3] Rockwell International, Report No. RI/RD96-140, *Annual Site Environmental Report Santa Susana Field Laboratory and De Soto Sites 1995*, Date Unknown.
[4] Rocketdyne Report, 363-AR-0001, *Decontamination and Decommissioning of Building T363*, September 25, 1997.
[5] Rocketdyne, Report No. 363-SP-0001, *Decontamination Procedure for Bay Four, Building 363,* May 8, 1995.
[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. Citing an August 12, 2003, personnel interview with Dan Trippeda.
[7] Boeing, *Specification Buildings 4363, 4375, and 4873 Addendum to Demolition Contract,* November 15, 2000.
[8] Boeing, *Specification Buildings 4363, 4375, and 4873 Addendum to Demolition Contract*, September 4, 2001.
[9] Schleck, Lennie, *Lead Work Plan for Construction Project, Project Title B4363 & 4353 Demolition,* December 8, 2000.
[10] Unknown Author, Notes Re: T363, April 6, 1992.

stated that the building was decontaminated and returned to normal use.[1] The survey plan does not provide a reference for this incident. An August 6, 1965, health and safety section monthly progress report indicated that a small sodium-water explosion occurred on July 26, 1965, in a hood in Building 4363 that resulted in the spread of radioactive contamination to the laboratory in the building. The maximum level of contamination was reported to have been 50,000 dpm/100 cm^2 beta-gamma.[2] An August 10, 1965, Atomics International internal letter also makes reference to the incident, indicating that Room 106 of Building 4363 had to be decontaminated. According to the letter, the room was decontaminated to a general average level of approximately 200 dpm/100 cm^2 with the exception of "certain items" that had surface and internal contamination levels of approximately 8,000 dpm/100 cm^2 and radiation levels of between 5 and 15 mrad/hr. During decontamination, according to the letter, the sink, hood, exhaust fan, and duct work were removed and prepared for disposal. As a result of the radiation and contamination levels, Room 106 in Building 4363 was reclassified as a "red tag area."[3] No 1965-era building drawings that refer to any of the rooms in Building 4363 as Room 106 were located; however, drawings do show the presence of an "experimental neutron physics" room. The purpose of the "experimental neutron physics" room could not be determined from available historical information.

Current Use: The California Department of Health Service (DHS) released the facility for unrestricted use July 9, 1998.[4] The building was demolished in 2001 and the sanitary leach field was removed in 2002.[5]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): According to the 1973 annual report for environmental and radioactive effluent monitoring, Building 4363 was part of the sample station monitoring program for soil and vegetation (SV-5), as well as for process water (W-11) and air (A-9), through 1989. The 1973 report, or any subsequent reports, did not include analytical data for each of these sampling stations, but provided averages for the entire site.[6] In 1983, a thermo luminescent dosimeter location (TLD-7), later referred to as SS-7, was added on the north side of Building 4363 to the sampling stations. The results of this quarterly data are presented in the annual environmental monitoring and facility effluent reports from 1983 through 1997. [7,8,9,10,11,1,2,3,4,5,6,7,8,9,10]

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[1] Rocketdyne, Report A4CM-AN-003, Rev. A, *Radiological Characterization Plan*, March 30, 1994.
[2] Lang, J.C., Atomics International Internal Letter Re: Health and Safety Section Monthly Progress Report – Period Ending August 4, 1965, August 6, 1965.
[3] Young, L.N., Internal Letter Re: Reclassification of Room 106, Building 363, August 10, 1965.
[4] Wesley, David, DHS/RHB, Untitled Letter Re: Release of Building 363, July 9, 1998.
[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. Citing an August 12, 2003, personnel interview with Dan Trippeda.
[6] Moore, J.D., *Environmental and Radioactive Effluent Monitoring Annual Report 1973*, Undated.
[7] Rockwell International, Report No. ESG-84-9, *Environmental Monitoring and Facility Effluent Annual Report 1983*, March 1984.
[8] Rockwell International, Report No. RI/RD85-123, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1984*, March 1985.
[9] Rockwell International, Report No. RI/RD86-140, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1985*,April 1986.
[10] Rockwell International, Report No. RI/RD87-133, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1986*, March 1987.
[11] Rockwell International, Report No. RI/RD88-144, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1987*, March 1988.

TLD-7/SS-7 (Building 4363) Ambient Radiation Dosimetry Data

Year	Quarterly Exposure (mR)				Annual Exposure (mR)	Equivalent Exposure at 1,000 feet above sea level	
	1st	2nd	3rd	4th		mR	μR/hr
1983	38	34	35	29	136	124	13
1984	35	31	39	21	126	114	12
1985	19	36	26	29	110	98	11
1986	22	29	33	33	117	105	12
1987	22	41	58	30	151	139	16
1988	27	14	31	14	86	82	10
1989	28	15	35	13	91	NLR	NLR
1990	15	10	10	15	50	NLR	NLR
1991	20	35	30	10	95	NLR	NLR
1992	10	10	30	10	60	NLR	NLR
1993	20	20	10	10	60	NLR	NLR
1994	33	33	33	33	132	NLR	NLR
1995	46	46	44	50	186	NLR	NLR
1996	26	26	25	30	107	NLR	NLR
1997	28	28	25	24	104	NLR	NLR

NLR = no longer reported

A chronology of all remaining available radiological investigations at this building is as follows:

- The June 1996 final radiological survey report for Building 4363 provided a summary of previously conducted radiological surveys. According to the report, in April 1992, stored equipment was removed from Bay 4 of Building 4363 and fixed beta contamination was detected on the floor. A more comprehensive survey conducted in April 1993 detected additional radioactive contamination on the west wall and overhead horizontal surfaces in Bay 4, including, but not limited to ducting, piping and light fixtures. Gamma spectrometry results of wall scraping indicated the presence of Cs-137 and low enrichment uranium (2.75%), and “presumed Sr-90 activity.” According to Rocketdyne, these results indicated that the activity resulted from work being performed on

[1] Rockwell International, Report No. RI/RD89-139, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1988*, May 1989.
[2] Rockwell International, Report No. RI/RD90-132, *Environmental Monitoring and Facility Effluent Annual Report De Soto and Santa Susana Field Laboratories Sites 1989*, May 1990.
[3] Rockwell International, Report No. RI/RD91-136, *Environmental Monitoring Annual Report Santa Susana Field Laboratory, De Soto, and Canoga Sites 1990*, June 20, 1991.
[4] Rockwell International, Report No. RI/RD92-138, *Environmental Monitoring Annual Report Santa Susana Field Laboratory and De Soto Sites 1991*, September 30, 1992.
[5] Rockwell International, Report No. RI/RD93-125, *Environmental Monitoring Annual Report Santa Susana Field Laboratory and De Soto Sites 1992*, December 14, 1993.
[6] Rockwell International, Report No. RI/RD94-126, *Annual Site Environmental Report Santa Susana Field Laboratory and De Soto Sites 1993*, October 21, 1994.
[7] Rockwell International, Report No. RI/RD95-153, *Annual Site Environmental Report Santa Susana Field Laboratory and De Soto Sites 1994*, September 30, 1995.
[8] Rockwell International, Report No. RI/RD96-140, *Annual Site Environmental Report Santa Susana Field Laboratory and De Soto Sites 1995*, Date Unknown.
[9] Boeing, Report No. RD97-134, *Rocketdyne Propulsion & Power DOE Operations Annual Site Environmental Report 1996*, November 10, 1997.
[10] Boeing, Report No. A4CM-ZR-0012, *Rocketdyne Propulsion & Power DOE Operations Annual Site Environmental Report 1997*, November 23, 1998.

components containing contaminated sodium from the SRE. Detectable activity on the floor area in April 1993 ranged from 25,000 to 142,000 dpm/100 cm^2 beta and hot spots on the west wall ranged from 25,000 to 730,000 dpm/100 cm^2 beta. Contamination on overhead horizontal surfaces (piping, ducts light fixtures, etc.) ranged from 7,300 to 33,000 dpm/100 cm^2 beta. According to Rocketdyne, the remaining portions of Building 4363 were not surveyed "because process knowledge at that time did not indicate that contaminated materials were worked on or transported into other parts of the building."[1] The June 1996 report did not indicate whether any building controls were initiated following the April 1993 survey and the decontamination activities in July 1995.

- Prior to the decontamination of Bay 4, Rockwell performed a radiological assessment of "the known and suspect" radiologically contaminated areas and components in Bay 4 of Building 4363. The assessment revealed both fixed and removable contamination on the walls, fire sprinkler piping, ducting, phone wires, north door handle and ceiling trusses inside bay four. Contamination ranged from 100 dpm/100 cm^2 on the west wall to 4,000 dpm/100 cm^2 in front of the north wall door. One smear location on the vent supply measured 42,000 dpm/100 cm^2.[2]

- Following a decontamination effort, Rocketdyne performed a final radiological survey for all of Building 4363 and the surrounding area in 1995. The entire area was divided into two sample lots and was surveyed for total and removable alpha and beta contamination, and ambient gamma. Sample Lot 1 comprised Bay 4, and Sample Lot 2 comprised Bays 1, 2, and 3, and the outside areas surrounding the building.

  Rocketdyne established the total and removable alpha and beta limits to be 5,000 and 1,000 dpm/100 cm^2, respectively. The ambient gamma limit was < 5 μR/hr above background with the average background exposure rate having been established to be 13.1 μR/hr. According to the report, the background exposure rates were measured "near" Building 4363; however, the report does not provide additional information to indicate where the measurement was taken. Rocketdyne reported the maximum total alpha measurements of Lot 1 and Lot 2 were 7.32 and 23.9 dpm/100 cm^2, respectively. The maximum removable alpha of Lot 1 and Lot 2 were 4.68 and 6.88 dpm/100 cm^2, respectively. The maximum total beta measured was 263 and 805 dpm/100 cm^2 for Lots 1 and 2, respectively. Lots 1 and 2 maximum removable beta measurements were 29.9 and 28.7 dpm/100 cm^2, respectively. The maximum ambient gamma at Lot 2 was 1.31 μR/hr above background. Rocketdyne summarized that "all tests for surface contamination showed that the facility [was] suitable for release without radiological restrictions."[3]

- During the 1996 Area IV Radiological Characterization Survey, soil and water samples were collected and analyzed as part of the Area IV radiological characterization. Randomly selected, two soil samples were taken in the vicinity of Building 4363. According to the report, none of the measurements were distinguishable from background and all the measurements were below the acceptable concentration levels established by Boeing in the 1998 approved site-wide release criteria for remediation of radiological

[1] Rocketdyne, Report No. SSWA-ZR-0002, *Final Radiological Survey Report for Building T363*, June 21, 1996.
[2] Waite, P., Internal Letter Re: Radiological Assessment of Building 363, Bay Four, May 11, 1995.
[3] Rocketdyne, Report No. SSWA-ZR-0002, *Final Radiological Survey Report for Building T363*, June 21, 1996.

facilities. Additionally, the ambient gamma survey results in the vicinity of Building 4363 measured 11.8 µR/hr on the east side of the building and 15.4 µR/hr on the northwest corner of the concrete pad surrounding Building 4363.[1]

- ORISE performed an independent verification survey of Building 4363 during the period of July 29, thru July 31, 1996. Surface scans for alpha, beta. and gamma activity and direct measurements for total alpha and total beta activity were performed on 100 percent of floor and lower wall surfaces, and five percent of upper surfaces using NaI scintillation, gas proportional, and/or ZnS detectors. Direct measurement for total alpha and total beta activity were performed at 36 randomly selected floor, lower wall, and upper surface locations. ORISE used the 1996 Rockwell-determined average interior background exposure rate of 13 µR/hr for building exposure rate comparisons.

  In addition to the interior of the building, ORISE also performed a verification survey of the loading dock and concrete slab located on the north, south, and west sides of Building 4363. Surface scans of exterior areas for alpha, beta, and gamma activity were performed using NaI scintillation and gas proportional detectors. Direct measurement for total alpha and total beta activity were also performed at ten randomly selected locations.

  According to the ORISE findings, surface scans of the interior of the building identified one area of total maximum direct beta radiation on the north door of Bay 4, but all other areas were within the range of "ambient site background." The total activity levels in the building ranges from less than 34 to 61 dpm/100 cm^2 and less than 230 to 4,600 dpm/100 cm^2 for alpha and beta, respectively. The 1-square meter average activity surrounding the location of the maximum direct beta radiation was 420 dpm/100 cm^2. The removable activity levels were less than 9 dpm/100 cm^2 for gross alpha and less than 15 dpm/100 cm^2 for gross beta. The site exposure rates measured ranged from 10 to 13 µR/hr.[2]

  Surface scans of the exterior of the building identified one area of elevated direct beta radiation on the concrete slab adjacent to the north door of Bay 4. The total activity levels of exterior surfaces ranged from less than 34 to 110 dpm/100 cm^2 and 330 to 6,200 dpm/100 cm^2 for alpha and beta, respectively. The 1-square meter average activity level was 79 dpm/100 cm^2 for alpha and 1,300 dpm/100 cm^2 for beta in the area of elevated direct radiation identified outside of Bay 4. The removable activity levels were less than 9 dpm/100 cm^2 for gross alpha and less than 15 dpm/100 cm^2 for gross beta.[3]

  Acceptable contamination limits and gamma exposure rates for releasing a facility for unrestricted use are prescribed in the DOE, the 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 4024. 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

[1] Rocketdyne, Report No. A4CM-ZR-0011, *Area IV Radiological Characterization Survey Final Report*, August 15, 1996.
[2] ORISE Document, no document number, "Verification Survey of Building T363, SSFL, Rockwell International, Ventura County, California," Vitkus, T. J., and J. R. Morton, October 1996.
[3] ORISE Document, no document number, "Verification Survey of Building T363, SSFL, Rockwell International, Ventura County, California," Vitkus, T. J., and J. R. Morton, October 1996.

Dismantling Order because at 5 micro roentgens 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]

Surface Contamination Guidelines from DOE Order 5400.5 (1990 and 1993)

Allowable Total Residual Surface Contamination (dpm/100 cm^2)			
Radionuclides	**Average**	**Maximum**	**Removable**
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. Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment, February 8, 1990, p. IV-6, and Change 2, January 1993.

- DHS also performed a verification survey of Building 4363 on July 30, 1996. According to the survey report, the survey results and the laboratory analysis results of the wipe samples in Building 4363, the building met the requirements of DECON-1 for release without radiological restriction. The DHS performed a general survey with "Ludlum model 19 Micro R meters" in an open field area surrounding the Building 4363 structure. The report indicated that dose rate measurements ranged from 11 μR/hr to 15 μR/hr in the open field, as well as within the building structure. The State team also performed contact measurements at fifteen locations within the structure with a concentration in Bay 4. The background measurement for the concrete slab in the interior of the building was taken at the northwest corner of the building slab, and was consistent with the background measurements taken by Rocketdyne personnel. The background measurement established an average reading of 10 μR/hr. The results of the contact survey measurements within the building ranged from 8 to 12 μR/hr, with the highest measurement being in Bay 4.

  DHS summarized the results to be less than twice background for the surrounding area, and the interior of Building 4363. And, as indicated above, the results of the contact measurements had activity levels below the acceptable surface contamination levels listed in DECON-1.[2]

- Tetra Tech EM Inc. (Tetra Tech), under contract with EPA, conducted an oversight verification and confirmation radiological survey in 2000 to perform independent measurements of areas not previously surveys, perform measurements of areas previously surveyed to establish comparability of survey methods and results, and to perform biased sampling of surfaces and areas that may retain radioactivity. Tetra Tech performed radiation surveys for alpha and beta-gamma radiation at Building 4363. According to the report, "no field measurements made by Tetra Tech indicated the presence of

[1] ORISE Document, no document number, "Verification Survey of Building T363, SSFL, Rockwell International, Ventura County, California," Vitkus, T. J., and J. R. Morton, October 1996.
[2] Kocul, Henry, and Lupo, Roger, *Confirmation Survey of Building T363*, July 30, 1996.

contamination at concentrations greater than the criteria contained in NRC Regulatory Guide 1.86." Additionally, none of the fixed-point measurements exceeded the "most restrictive, allowable, average surface contamination limits," and none of the removable contamination samples contained radioactivity greater than the criteria contain in the regulation noted above.[1]

The surveys of Building 4363 included scans and fixed point measurements for alpha and beta. In addition, the survey included swipe samples for removable contamination and concrete samples for isotopic analysis. The COCs for Building 4363 were mixed fission products and uranium on the floors and walls, based on previous survey results. Fixed point measurements of the building identified one point of elevated alpha and beta-gamma readings (alpha was 49.8 ± 38 dpm/100 cm^2 and beta gamma was 4,753 ± 565 dpm/100 cm^2) in Bay 4. The beta-gamma activity was reported to have exceeded one-half of the surface activity release limit. Tetra Tech reported that all other results were below the 1974 NRC acceptable limits as well as the proposed site-wide release criteria documented in Rocketdyne's 1996 Final Radiological Survey Report for Building 4364.[2,3]

Radiological Use Authorizations: One use authorization relating to operations at Building 4363 has been identified. Use Authorization No. 166 related to the surveillance of existing contamination in Building 4363 and was issued on December 1, 1993. The use authorization was renewed on December 7, 1994, December 23, 1995, and on February 11, 1997. The use authorization specified that the building could not be "divested from company ledgers until the building [was] decontaminated to meet State of California release criteria."[4,5,6,7]

Former Radiological Burial or Disposal Locations: According to the 2005 HSA, citing a 1997 decontamination and decommissioning report, Building 4363 had an associated leach field measuring 100 by 4 by 3 feet with a septic tank capacity of 1,500 gallons (see Figure 2.3.4e).[8] The research team is in the process of acquiring the 1997 report.

Aerial Photographs: In 1952, the area comprising the future Building 4363 area is agricultural land. By 1957, two buildings have been constructed in the Building 4363 area. In August 1959, the Building 4363 area remained relatively unchanged with the exception of the appearance of a linear ground scar from the northeast corner of the building to a point at J Street. The linear ground scar appears to correspond with the 6-inch vitrified clay pipe sanitary sewer line depicted in 1964 plot plans of the facility. The area remains unchanged until 1978 with the appearance of

[1] Tetra Tech, *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-012, T-029, and T-363*, December 20, 2002.
[2] Rocketdyne, Report No. SSWA-ZR-0002, *Final Radiological Survey Report for Building T363*, June 21, 1996.
[3] Tetra Tech, *Final Oversight Verification and Confirmation Radiological Survey Report for Buildings T-012, T-029, and T-363*, December 20, 2002.
[4] Barnes, J.G., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization Number 166, December 1, 1993.
[5] Barnes, J.G., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization Number 166A, December 7, 1994.
[6] Barnes, J.G., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization Number 166B, December 23, 1995.
[7] Barnes, J.G., Authorization for Use of Radioactive Materials or Radiation Producing Devices, Authorization Number 166C, February 11, 1997.
[8] Rocketdyne Report, 363-AR-0001, *Decontamination and Decommissioning of Building T363*, September 25, 1997.

probable storage tanks, stains, and probable overhead pipelines. Identified by the 2010 aerial photograph interpretation as a processing area, this area remained active through the early 1990s. In 1995 the area appears to no longer be active, and by 2003 all structures related to this processing area have been removed. By 2005 the former Building 4363 area is vegetated.[1]

Radionuclides of Concern: Based on the limited, available historical documents, Building 4363 was used to support the SRE. As indicated above, based on a review of dosimetry data and available historical documents in 1994, Mr. Tuttle reported that contamination of Building 4363 may have resulted from work on a component containing contaminated sodium from the SRE Core I accident, which occurred in Building 4143 in 1959. The SRE accident dispersed low enriched uranium and mixed fission products in the sodium, which was the same type of contamination found at Building 4363.[2] Therefore, the primary radionuclides of concern for this site are uranium, mixed fission and activation products.[3]

Drainage Pathways: 1957 site drawings and plot plans show a drainage ditch beginning at the southwest corner of the building, then flowing north along the west end of the building, then flowing east along the northern boundary of the building to an area east of the building where the drawing indicates that the ditch should be run "so drainage will discharge to south of building."[4] (See Figure 2.3.4e.) Currently, surface water within the vicinity of former Building 4363 drains to the southeast into the ditch on the north side of former L Street. Surface water then runs east along former L Street till it dead ends, where it then flows southeast into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4363 area is Class 1 because of the high levels of radioactive contamination found in the building and the limited operational information available regarding the processes employed in Building 4363. In addition, an Atomics International internal letter, on May 3, 1965, stated that Building 4363 received three moderator can samples from the SRE to be "potted."[5] Available documents did not provide information regarding this process or its duration.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4363 area. As discussed above, there were no reported radiological incidents at Building 4363; however, secondary documents provide information regarding an explosion that may have occurred resulting in the decontamination of Room 106. In addition, significant information is lacking regarding the disposal and demolition of Building 4363 and the building's sanitary leach field.

Previous characterization studies for the Building 4363 area were focused on delineating the extent of contamination to standards that were applicable at the time. This characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] Tuttle, R.J., Internal Letter Re: Study of Possible Source of Radioactive Contamination in T363, September 9, 1994.
[3] ORISE Document, no document number, "Verification Survey of Building T363, SSFL, Rockwell International, Ventura County, California," Vitkus, T. J., and J. R. Morton, October 1996.
[4] Atomics International, Drawing No. 303-363-C13, *Grading and Plot Plan, Building 363 Remodel*, 1957.
[5] Tschaeche, A.N., Internal Letter Re: Dose Rates from Moderator Can Samples from SRE at Building 363, May 5, 1965.

2010 AOC. Therefore, additional characterization is recommended for the Building 4363 area. This includes the following Building 4363 areas and appurtenances:

- The former Building 4363 footprint should be sampled. R.J. Tuttle identified possible sources of radioactive contamination in Bay 4 of Building 4363 as having been a result of the building's use in support of the SRE. Bay 4 showed spotty contamination consisting of Cs-137, uranium, and Sr-90.[1]

- The former location of Room 106 of Building 4363 should be evaluated. An August 10, 1965, Atomics International internal letter references an incident report dated July 26, 1965, whereby Room 106 of Building 4363 had to be decontaminated. According to the letter, the room was decontaminated to a general average level of approximately 200 dpm/100 cm^2 with the exception of "certain items" that had surface and internal contamination levels of approximately 8,000 dpm/100 cm^2 and radiation levels of between 5 and 15 mrad/hr.[2]

- The drainage channels surrounding Building 4363 should be sampled. 1957 site drawings and plot plans show a drainage ditch beginning at the southwest corner of the building, then flowing north along the west end of the building, then flowing east along the northern boundary of the building to an area east of the building where the drawing indicates that the ditch should be run "so drainage will discharge to south of building."[3]

2.3.5 Building 4375 Area

Site Description: The Building 4375 area includes Building 4375 and the surrounding area located outside of the government-optioned portion of Area IV east of 24th Street and south of J Street. Building 4375 was a 400-square foot steel-framed building constructed in 1959 that was adjacent to control rod test tower Buildings 4874 and 4875, discussed below. Figures 2.3.5a through 2.3.5d 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: Limited information regarding the construction of this building has been located, to date. Building 4375 was a test shelter for testing SNAP control rod assemblies. The building measured 400 square feet in size and had a steel frame with steel roof and siding. In 1988, the surrounding area was cluttered with debris and metal components.[4]

A 1958 engineering drawing shows the installation of a drain tank pit at the Building 4375 area. According to the drawing, the pit was located near the southeast corner of Building 4375 along the eastern boundary of the existing concrete slab. The drawing shows the addition of 40 feet of 4-inch vitrified clay drain line from the pit to "terminate at existing drainage ditch."[5]

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[1] Tuttle, R.J., Internal Letter Re: Study of Possible Source of Radioactive Contamination in T363, September 9, 1994.
[2] Young, L.N., Internal Letter Re: Reclassification of Room 106, Building 363, August 10, 1965.
[3] Atomics International, Drawing No. 303-363-C13, *Grading and Plot Plan, Building 363 Remodel*, 1957.
[4] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[5] Atomics International, Drawing 303-375-C1, *Drain Tank Pit and 15HP Pump Installation Bldg #375 Area*, April 4, 1958.

Former Use(s): Operational information for Building 4375 is limited. According to a June 1960 Atomics International technical data record, an environmental test loop was located at Building 4375 and was originally designed to perform creep tests on full-size OMR Piqua-type fuel elements. In 1960, the loop was used for the environmental testing of proposed fuel elements for organic reactors. The environmental test loop, or "Loop B," was constructed primarily of 4-inch carbon steel pipe with a test chamber fabricated from 10-inch pipe. The proper rearrangement of piping was reported to allow the "reversal of flow of organic through the test chamber." A stainless steel centrifugal pump was used as the prime mover, and a durametallic seal was used to seal the pump shaft. The seal was cooled with de-ionized water.[1]

A surge tank, common to both the loop and the test chamber, was used for pressurization during testing and operation. A drain tank located in a pit was utilized for coolant storage and was connected to the main system through an air-operated dump valve. The operational and shutdown controls were mounted on a control instrument rack. When the loop achieved steady-state operation, the loop was operated and controlled automatically. The technical data record indicated that the following tests had been conducted at Building 4375: [2]

1. OMRE fuel element environmental and pressure drop tests
2. OMRE fuel element hot wire anemometer calibration
3. Flat-finned pate Piqua element environmental test
4. Circular-finned Piqua element environmental and pressure drop tests

A second loop located at Building 4375 was the AOMR fouling test loop, which determined the long-term heat transfer characteristics of various heat transfer configurations. The loop was constructed of welded 2-inch mild steel pipe with flanged components. Circulation of the organic coolant was accomplished by a centrifugal, hot-oil process-type pump. The technical data record indicated that limited nucleate boiling tests may also be conducted in the loop; however, evidence of these operations has not been located.[3]

The available information regarding Building 4375 operations is presented in the 1988 radiological survey report. According to that report, Building 4375 was constructed in 1959 and served as a test shelter for outside control-rod test towers (Buildings 4874 and 4875). Building 4375 was used as a non-nuclear control center for testing SNAP control rod assemblies in support of the SNAP program. Building 4375, as indicated above, was located outside of the government-optioned portion of Area IV and was owned by Atomics International. Test operations at Building 4375 proceeded through 1968. Following completion of the SNAP program, Buildings 4373, 4374, and 4375 were cleared of SNAP components. These included the outside test tower, Building 4874, as well as tanks, piping, valves, instrumentation, and controls. According to the 1988 radiological survey, a radiological survey was performed to clear the building for non-nuclear use; however the referenced survey has not been located in the available documents.[4]

[1] Huber, D.A., Atomics International Technical Data Record, *Advanced OMR, Convective Heat Transfer*, June 24, 1960.
[2] Huber, D.A., Atomics International Technical Data Record, *Advanced OMR, Convective Heat Transfer*, June 24, 1960.
[3] Huber, D.A., Atomics International Technical Data Record, *Advanced OMR, Convective Heat Transfer*, June 24, 1960.
[4] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.

The 1988 radiological survey indicated that handling of radioactive material at Building 4375 was unknown. As of 1988, it was reported the building was "abandoned and dilapidated," and the surrounding area was cluttered with debris in certain locations. The report stated that after the building was abandoned, barrels were stored in the surrounding areas.[1] The contents of the barrels or from where they originated is unknown. It is also unknown the duration of these storage activities.

According to the 2005 HSA, the building was demolished in 1999.[2] However, on November 15, 2000, and on September 4, 2001, Boeing issued addenda to the demolition contract specifying that the contractor "shall provide all labor, materials, and equipment to remove all remaining structural walls, concrete foundations, retaining walls, pits and asphalt concrete drives associated with Building(s) 4375, 4363, and 4873." The addenda did not specify the specific activities relating to the demolition of Building 4375.[3,4] Boeing continued to issue addenda for the demolition of Building 4375 through April 2003.[5] The 2010 aerial photograph interpretation indicates that all structures in the Building 4375 area are removed by 2003.[6]

Information from Interviewees: None to date.

Radiological Incident Reports: None found.
Current Use: DHS released the facility for unrestricted use on May 9, 1995.[7] The exact demolition date of Building 4375 is unknown at this time; however, the 2010 aerial photograph interpretation indicates that all structures in the Building 4375 area are removed by 2003.[8] The site is presently vegetated.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): In 1988, Rocketdyne performed a radiological survey at Building 4375 to determine if any residual contamination existed. The radiation measurements taken during the survey were compared against the DOE residual radioactivity limits specified in "Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites." The maximum acceptable contamination limits used in 1988 are presented below:

1988 Maximum Acceptable Contamination Limits

Criteria	Alpha (dpm/100 cm^2)	Beta (dpm/100 cm^2)
Total Surface, averaged over 1 m^2	5,000	5,000
Maximum Surface, in 1 m^2	15,000	15,000
Removable Surface, over 100 cm^2	1,000	1,000
Ambient Gamma Exposure Rate	5 µR/hr above background*	

*The DOE guide recommended a value of 20 µR/hr above background for the ambient gamma exposure rate; however, the NRC required 5 µR/hr. Accordingly, Rockwell used the more stringent requirement.

[1] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[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.
[3] Boeing, *Building(s) 4363, 4375, and 4873 Addendum to Demolition Contract*, November 15, 2000.
[4] Boeing, *Building(s) 4353, 4363, 4375, and 4873 Addendum to Demolition Contract*, September 4, 2001.
[5] Boeing, *Building(s) 4353, 4363, 4375, and 4873 Addendum to Demolition Contract*, April 23, 2003.
[6] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[7] Wong, Gerard, DHS/RHB Letter Re: ETEC's Radiological Survey Report of Buildings T373 and T375, May 9, 1995.
[8] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

According to the 1988 radiological survey, the Building 4375 survey included a survey of the gamma exposure rate of the surface of the building and the grounds from J to L Streets and from 24th to 22nd Streets. Seventy-nine gamma exposure rate measurements were taken surrounding Building 4375, and a combined total of 29 gamma exposure rate measurements were taken within Buildings 4374 and 4375. The report indicated that no soil samples were collected because there was no indication of contamination as a result of the gamma exposure rate measurements. As indicated above, the measured ambient gamma limit was < 5 μR/hr above background, which was measured to be between 14 and 16 μR/hr.[1] The maximum measured ambient gamma in Buildings 4374 and 4375 was 9.3 μR/hr, and 13.7 μR/hr for the area surrounding Building 4375. The survey concluded that survey results were below the Rocketdyne 1988 acceptable limits and no further inspection was required at Building 4375.[2]

The Building 4375 area was also included in the Area IV Radiological Characterization Survey conducted in 1994 and 1995. Located in the central portion of survey block H12, the Building 4873 area ambient gamma survey result measured between 13.0 and 14.1 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Building 4375 area were found to be below the then-acceptable limits.[3,4]

Radiological Use Authorizations: Based on the review of currently available documents, there was no radiological use authorization associated with the operations at Building 4375.

Former Radiological Burial or Disposal Locations: As indicated above, a 1958 engineering drawing shows the installation of a drain tank pit near the southeast corner of Building 4375 along the eastern boundary of the existing concrete slab. The drawing shows the addition of 40 feet of 4-inch vitrified clay drain line from the pit to “terminate at existing drainage ditch.”[5] Based on the available historical information regarding the building’s operations, the purpose of the drain tank pit at Building 4375 is unknown and it cannot be stated whether radiological materials entered this drainage system as a result of building operations.

Aerial Photographs: In 1952, the area comprising the future Building 4375 is agricultural farmland. By 1957, the area has become developed with the construction of a building, Building 4363, South of the Building 4375 area. The 1957 area photographs shows a linear ground scar leading from the future Building 4375 area to the intersection of 22nd and L Street. This ground scar appears to correspond to a drainage channel referenced in Building 4375 construction drawings. In 1959, the Building 4375 area has been developed and the building structure is visible. The aerial photograph interpretation notes the presence of three “square objects” located immediately south of Building 4375. The aerial photographs marked 1962/1963 in the aerial photograph interpretation clearly show Building 4874 north of Building 4375; however, few additional features are visible as a result of the increased site development.[6] The site appears to

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[1] According to the 1988 survey report, an average of 38 background measurements were taken at three locations at the SSFL – the Building 4309 area, Well #13 Road, and Incinerator Road.
[2] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[3] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.
[4] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.
[5] Atomics International, Drawing 303-375-C1, *Drain Tank Pit and 15HP Pump Installation Bldg #375 Area*, April 4, 1958.
[6] The date of the 1962/1963 aerial photographs has been determined to be approximately 1960 plus or minus a year.

be unchanged through 1967 with the appearance of dark-toned material to the north of Building 4874. Limited detail is visible in the 1972 aerial photographs; however, it appears there are construction activities to the east of the Building 4375 area in the future location of Buildings 4473 and 4863, discussed below. Beginning in 1978, the aerial photograph interpretation begins to refer to the area as process area 5. Stains, as well as probable storage tanks are visible in this area, comprising Buildings 4363, 4873, 4875, 4375, 4874, 4473, and 4863. A stain is clearly visible to the east of Building 4375 in May 1978. In 1980, Building 4874 no longer appears to be present; however, a concrete pad remains. The area to the east of Building 4375 appears to be an area of increased activity. This area continues to contain more materials in subsequent photographs until 1995 when the area, according to the aerial photograph interpretation, appears to be abandoned. By 2003, all structures related to process area 5 have been removed from the location, and by 2005, the area is vegetated.[1]

Radionuclides of Concern: Evidence that high activity radioactive materials were used or stored at Building 4375 could be located. As indicated above, Building 4375 was used to support the SNAP program, but does not appear to have been involved in nuclear work. After the building was abandoned, barrels that may have contained radioactive material were stored in the surrounding area; however, information regarding these barrels could not be located.

Drainage Pathways: According to a 1958 engineering drawing, a drainage ditch was located to the east of the Building 4375 area. The drawing depicted a 4-inch drain line that originated from a drain tank pit near the southeast corner of Building 4375 and terminated at an "existing drainage ditch."[2] Currently, surface water in the vicinity of former Building 4375 flows to the south-southeast to former L Street, then east until former L Street ends, where it then flows southeast into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4375 area is Class 2, due to the unknown nature of its operations in support of the SNAP program and its proximity to Building 4055.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4375 area. Limited information regarding the operations of Building 4375 could be located; however, it was reported the building served as a non-nuclear facility. Following the building operations, the area surrounding the building appears to have served as an outside storage area.

Previous characterization studies for the Building 4375 area were focused on delineating the extent of contamination to standards that were applicable at the time. This characterization was not conducted to delineate the extent of contamination consistent with the DTSC/DOE December 2010 AOC. Therefore, additional characterization is recommended for the Building 4375 area. This includes the following Building 4375 areas and appurtenances:

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[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] Atomics International, Drawing 303-375-C1, *Drain Tank Pit and 15HP Pump Installation Bldg #375 Area*, April 4, 1958.

- The area surrounding the former Building 4375 location is recommended for sampling. The area appears to have served as an outside storage area of numerous barrels after operations ceased; however, the contents of the barrels are unknown.

- Based on a 1958 engineering drawing, a drain tank pit was installed near the southeast corner of Building 4375 along the eastern boundary of the existing concrete slab. The drawing shows the addition of 40 feet of 4-inch vitrified clay drain line from the pit to "terminate at existing drainage ditch."[1] Based on the available historical information regarding the building's operations, the purpose of the drain tank pit at Building 4375 is unknown. It is also unknown whether radiological materials entered this drainage system as a result of building operations. The drain tank pit and vitrified clay drain line are recommended for sampling.

- The former Parking Lot 4575 area is recommended for sampling. The parking lot is discussed below; however, given its proximity to Building 4375, it is recommended the parking lot be included in the sampling plan for Building 4375. More specifically, sampling is recommended surrounding the perimeter of Parking Lot 4575 along 24th Street and J Street.

- The former locations of Buildings 4874 and 4875 are recommended for sampling. Given their proximity to Building 4375, it is recommended these buildings be included in the sampling plan for Building 4375.

2.3.6 Parking Lot 4575 Area

Site Description: The Parking Lot 4575 area comprises the parking lot near Buildings 4375 and 4473, and the surrounding area. This area is located at the southeast corner of J and 24th Streets and appears to extend down along 24th Street to L Street. This area is never identified as an established parking lot in any of the available industrial planning maps. The 2005 HSA identified Parking Lot 4575 as a site investigation area, and as a result, it has been included in this TM. Figures 2.3.6a provides a current photograph. Plate 1 presents a summary of all identified features for this site.

Building Features: There are no building features to report for Parking Lot 4575. There is limited information available to indicate when this parking lot was constructed. As indicated above, available industrial planning maps do not show the presence of an established parking lot in this area; however the area surrounding the Building 4375 area appears to be paved in aerial photographs. The area identified by the 2005 HSA as Parking Lot 4553 is located northwest of the Building 4375 area, discussed above, at the southwest corner of J and 24th Streets and appears to extend down along 24th Street to L Street.[2,3]

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[1] Atomics International, Drawing 303-375-C1, *Drain Tank Pit and 15HP Pump Installation Bldg #375 Area*, April 4, 1958.
[2] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, 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.

Former Use(s): Parking Lot 4575 appears to have been mainly used for its intended purpose of serving personnel working in the facilities at and around Building 4375.[1]

Information from Interviewees: None to date.

Radiological Incident Reports: There have been no incident reports associated with operations at Parking Lot 4575 identified to date.

Current Use: Based on aerial photographs, the area comprising the former Parking Lot 4575 is vegetated.[2]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Parking Lot 4575 have not been conducted; however, the area surrounding Building 4375, including the former parking lot area, was surveyed in 1988 by Rocketdyne. The area, as indicated above in the description of previous radiological investigations for Building 4375, was surveyed for mixed fission products by measuring the ambient gamma exposure rates.

According to the 1988 radiological survey, the Building 4375 survey included a survey of the gamma exposure rate of the grounds from J to L Streets and from 24th to 22nd Streets. Seventy-nine gamma exposure rate measurements were taken surrounding Building 4375. The report indicated that no soil samples were collected because there was no indication of contamination as a result of the gamma exposure rate measurements. As indicated above, in Section 2.3.5, the measured ambient gamma limit was < 5 μR/hr above background, which was measured to be between 14 and 16 μR/hr.[3] The maximum measured ambient gamma surrounding Building 4375 was 13.7 μR/hr. The survey concluded that survey results were below the 1988 acceptable limits and no further inspection was required at Building 4375.[4]

Additionally, according to the Area IV Radiological Characterization Survey, the area was included in the survey conducted in 1994 and 1995. Located in the northwestern portion of survey block H12 with Building 4375, the Parking Lot 4575 area ambient gamma survey results measured between 14.7 and 16.6 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Parking Lot 4575 area were found to be below the then-acceptable limits.[5,6]

Radiological Use Authorizations: None.

Former Radiological Burial or Disposal Locations: None.

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[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[3] According to the 1988 survey report, an average of 38 background measurements were taken at three locations at the SSFL – the Building 4309 area, Well #13 Road, and Incinerator Road.
[4] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[5] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.
[6] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.

Aerial Photographs: In 1952, the area comprising the future Parking Lot 4575 is agricultural farmland. By 1957, the area has become developed with the construction of a building, Building 4363, South of the future parking lot area. The 1957 area photographs shows a linear ground scar leading from the future Building 4375 area to the intersection of 22nd and L Street. This ground scar appears to correspond to a drainage channel referenced in Building 4375 construction drawings.[1] In 1959, the Building 4375 area has been developed and the area surrounding the building appears to be paved and vehicles are visible on the paved areas. The aerial photographs marked 1962/1963 in the aerial photograph interpretation clearly show the area to be paved with ingress and egress to the parking area available from J Street and 24th Street.[2] The site appears to be unchanged through 1967 with the appearance of dark-toned material to the north of Building 4874. Limited detail is visible in the 1972 aerial photographs. Beginning in 1978, the aerial photograph interpretation begins to refer to the area comprising the buildings to the east of the Parking Lot 4575 area as process area 5. Stains, as well as probable storage tanks are visible in this area, comprising Buildings 4363, 4873, 4875, 4375, 4874, 4473, and 4863. By 1988, the area comprising the Parking Lot 4575 area has become vegetated. By 2003, all structures related to process area 5 have been removed from the location, and by 2005, the area, including the parking lot, is vegetated.[3]

Radionuclides of Concern: None.

Drainage Pathways: According to a 1958 engineering drawing and aerial photographs, a drainage ditch was located to the east of the Parking Lot 4575 area.[4,5] In addition, a drainage channel was located on the south side of J Street on the northern boundary of the Parking Lot 4574 area, and carried surface water east toward 22nd Street.[6] Currently, surface water in the vicinity of former Parking Lot 4575 drains to the north into the ditch that runs along the south side of J Street. The surface water then flows east along J Street into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Parking Lot 4575 area is Class 3 because of the parking lots use for intended purposes and no evidence of any outside storage activities at or near Parking Lot 4553.

Recommended Locations for Soil/Sediment Sampling: It is recommended this area be evaluated for sampling as part of Building 4375, discussed above.

2.3.7 Building 4874 Area

Note: To date, limited historical documents relating to the construction and operation of Building 4874 has been located. As a result, the information provided below is limited and is based mostly on information from Building 4375, which was the test shelter for Building 4874.

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[1] Atomics International, Drawing 303-375-C1, *Drain Tank Pit and 15HP Pump Installation Bldg #375 Area,* April 4, 1958.
[2] The date of the 1962/1963 aerial photographs has been determined to be approximately 1960 plus or minus a year however, the research team will continue to use the dates as they are marked on the aerial photograph figures in the attached report.
[3] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[4] Atomics International, Drawing 303-375-C1, *Drain Tank Pit and 15HP Pump Installation Bldg #375 Area,* April 4, 1958.
[5] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[6] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

Additional information may become available when the documents from Boeing's 1.4 million document database are reviewed.

Site Description: The Building 4874 area includes Building 4874 and the surrounding area and is located north of Building 4375 at the southeast corner of J and 24th Streets, outside the boundaries of the government-optioned portion of Area IV. Building 4874 was constructed in the late 1950s and served as a test tower in support of Building 4375. Figures 2.3.7a through 2.3.7d provide a current photograph and the best available building-specific drawings and photographs that the research team could find. Plate 1 presents a summary of all identified features for this site.

Building Features: Limited information is available regarding the features of Building 4874. Building 4874 was located outside of the government-optioned portion of Area IV and was owned by Atomics International. The site is identified on industrial planning maps as a control rod test tower and pad. The height of the tower was 90 feet high (Figure 2.3.7d). The 1988 survey report indicated that the facility included tanks, piping valves, instrumentation, and controls that were all removed following the completion of testing operations. A bridge crane inside the structure permitted the handling of the full-scale control rods, which were suspended inside of tubular electric furnaces that duplicated reactor operating temperatures.[1,2,3,4]

Former Use(s): Operational information for Building 4874 is limited. According to the 1988 radiological survey report, Building 4874 was a control rod test tower. The survey report stated that Building 4375 was constructed as a test shelter for outside control-rod test towers (Buildings 4874 and 4875). These tests were reported to have been non-nuclear testing of SNAP control rod assemblies in support of the SNAP program. Test operations at Building 4375 proceeded through 1968, according to the survey report. Following completion of the SNAP program, Buildings 4373, 4374, and 4375 were cleared of SNAP components, which included the outside test tower, Building 4874, as well as tanks, piping, valves, instrumentation, and controls. According to the 1988 radiological survey, a radiological survey was performed to clear Building 4375 for non-nuclear use; however, available documents did not include a summary of the referenced survey. Additionally, it is unknown if the survey included Building 4375, or only related to Buildings 4373 and 4374, discussed above.[5,6]

The 1988 radiological survey indicated that handling of radioactive material at the Building 4375 area, including Building 4874, was unknown. As of 1988, it was reported the building was "abandoned and dilapidated," and the surrounding area was cluttered with debris in certain locations. The report stated that after the building was abandoned, barrels were stored in the surrounding areas.[7] The contents of the barrels or from where they originated is unknown. It is also unknown the duration of these storage activities.

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[1] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[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.
[3] Atomics International, Nuclear Development Field Laboratories, January 1, 1967.
[4] Atomics International, Document No. AI-5316, *A Materials Research Proposal for Advanced Nuclear Space Systems*, June 13, 1960.
[5] Atomics International, Document No. AI-5316, *A Materials Research Proposal for Advanced Nuclear Space Systems*, June 13, 1960.
[6] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[7] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.

According to the 2005 HSA, Building 4874 was demolished in the early 1970s. The building remains visible on industrial planning maps until 1973.[1,2,3]

Information from Interviewees: There have been no interviews conducted to date regarding Building 4874.

Radiological Incident Reports: None found.

Current Use: As indicated above, the 2005 HSA stated that Building 4874 was demolished in the early 1970s. Aerial photographs from 1972 do not provide enough detail to determine whether the facility has been demolished; however by 1978, it is clear the facility has been removed and concrete pads remain.[4,5] Presently, the area comprising the former Building 4874 area is vegetated.

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): In 1988, Rocketdyne performed a radiological survey at Building 4375 and the surrounding area to determine if any residual contamination existed. The radiation measurements taken during the survey were compared against the DOE residual radioactivity limits specified in "Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites." The maximum acceptable contamination limits used in 1988 are presented in Section 2.2.5., above.

According to the 1988 radiological survey, the Building 4375 survey included a survey of the gamma exposure rate of the grounds from J to L Streets and from 24th to 22nd Streets, including the former location of Building 4874. Seventy-nine gamma exposure rate measurements were taken surrounding Building 4375. The report indicated that no soil samples were collected because there was no indication of contamination as a result of the gamma exposure rate measurements. As indicated above, the measured ambient gamma limit was < 5 μR/hr above background, which was measured to be between 14 and 16 μR/hr.[6] The maximum measured ambient gamma surrounding Building 4375 was 13.7 μR/hr. The survey concluded that survey results were below the Rocketdyne 1988 acceptable limits and no further inspection was required at Building 4375.[7]

As reported in the Area IV Radiological Characterization Survey, the area was included in the survey conducted in 1994 and 1995. Located in the central portion of survey block H12, the Building 4874 area ambient gamma survey result measured between 13.0 and 16.2 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Building 4874 area were found to be below the then-acceptable limits.[8,1]

[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.
[2] Atomics International, Nuclear Development Field Laboratories, March 1973.
[3] Atomics International, Nuclear Development Field Laboratories, March 1975.
[4] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 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.
[6] According to the 1988 survey report, an average of 38 background measurements were taken at three locations at the SSFL – the Building 4309 area, Well #13 Road, and Incinerator Road.
[7] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[8] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.

Radiological Use Authorizations: Based on the review of currently available documents, there was no radiological use authorization associated with the operations at Building 4874.

Former Radiological Burial or Disposal Locations: None.

Aerial Photographs: In 1952, the area comprising the future Building 4874 is agricultural farmland. By 1957, the area has become developed with the construction of a building, Building 4363, South of Building 4874. In 1959, the Building 4375 area has been developed and the building structure is visible. The aerial photographs marked 1962/1963 in the aerial photograph interpretation clearly show Building 4874; however, few additional features are visible as a result of the increased site development.[2] The site appears to be unchanged through 1967 with the appearance of dark-toned material to the north of Building 4874. Limited detail is visible in the 1972 aerial photographs; however, it appears there are construction activities to the east of the Building 4874 area in the future location of Buildings 4473 and 4863, discussed below. Beginning in 1978, the Building 4874 structure is no longer visible and a concrete pad remains. The aerial photograph interpretation begins to refer to the area as process area 5. Stains, as well as probable storage tanks are visible in this area, comprising Buildings 4363, 4873, 4875, 4375, 4874, 4473, and 4863. A stain is clearly visible to the east of Building 4375 in May 1978. The area to the east of Building 4375 appears to be an area of increased activity. This area continues to contain more materials in subsequent photographs until 1995 when the area, according to the aerial photograph interpretation, appears to be abandoned. By 2003, all structures related to process area 5 have been removed from the location, and by 2005, the area is vegetated.[3]

Radionuclides of Concern: Evidence that radioactive materials were used or stored at Building 4874 could not be located. As indicated above, Building 4874 was used to support the SNAP program, but does not appear to have been involved in nuclear work. After the building was abandoned, barrels that may have contained radioactive material were stored in the surrounding area; however, information regarding these barrels could not be located.

Drainage Pathways: According to a 1958 engineering drawing, a drainage ditch was located to the east of the Building 4375 and Building 4874 area. The drawing depicted a 4-inch drain line that originated from a drain tank pit near the southeast corner of Building 4375 and terminated at an "existing drainage ditch."[4] Currently, surface water in the vicinity of former Buildings 4375 and 4874 flows to the south-southeast into the ditch on the north side of former L Street, then east until former L Street ends, where it then flows southeast into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4874 area is Class 2, due to the unknown nature of its operations in support of the SNAP program and its proximity to Building 4055.

Recommended Locations for Soil/Sediment Sampling: It is recommended this area be evaluated for sampling as part of Building 4575, discussed above.

[1] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.
[2] The date of the 1962/1963 aerial photographs has been determined to be approximately 1960 plus or minus a year however, the research team will continue to use the dates as they are marked on the aerial photograph figures in the attached report.
[3] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[4] Atomics International, Drawing 303-375-C1, *Drain Tank Pit and 15HP Pump Installation Bldg #375 Area*, April 4, 1958.

2.3.8 Building 4875 Area

Note: To date, limited historical documents relating to the construction and operation of Building 4875 has been located. As a result, the information provided below is limited and is based mostly on information from Building 4375, which was the test shelter for Building 4875.

Site Description: The Building 4875 area includes Building 4875 and the surrounding area and is located west of Building 4375 at the southeast corner of J and 24th Streets, outside the boundaries of the government-optioned portion of Area IV. Building 4875 was constructed in the late 1950s and served as a "creep loop tower" in support of Building 4375. Information could not be located in available documents to indicate the functions of a "creep loop tower." Figure 2.3.8a provides a current photograph of the site, and Figure 2.3.8b provides an aerial view of the site in 1958. Facility drawings for Building 4875 have not been located. Plate 1 presents a summary of all identified features for this site.

Building Features: Limited information is available regarding the features of Building 4875. Building 4875 was located outside of the government-optioned portion of Area IV and was owned by Atomics International. The site is identified on industrial planning maps as a control pad and creep loop tower. The height of the tower is unknown; however, aerial oblique photographs of the site in 1958 included in the 2005 HSA show the tower to be slightly shorter than Building 4874, but still taller than surrounding utility poles (Figure 2.3.8b). Additional details regarding the structure could not be located.[1,2,3]

Former Use(s): Operational information for Building 4875 is limited. According to the 1988 radiological survey report, Building 4375 was constructed as a test shelter for outside control-rod test towers (Buildings 4874 and 4875). These tests were reported to have been non-nuclear testing of SNAP control rod assemblies in support of the SNAP program. Test operations at Building 4375 proceeded through 1968, according to the survey report. According to the 1988 radiological survey, a radiological survey was performed to clear Building 4375 for non-nuclear use; however, the referenced survey was not located in the available documents received to date. Additionally, it is unknown if the survey included Building 4375 and the control towers (Buildings 4875 and 4874), or only related to Buildings 4373 and 4374, discussed above.[4]

The 1988 radiological survey indicated that handling of radioactive material at the Building 4375 area, including Building 4874, was unknown. As of 1988, it was reported the building was "abandoned and dilapidated," and the surrounding area was cluttered with debris in certain locations. The report stated that after the building was abandoned, barrels were stored in the surrounding areas.[5] The contents of the barrels or from where they originated is unknown. It is also unknown the duration of these storage activities.

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[1] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[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.
[3] Atomics International, Nuclear Development Field Laboratories, January 1, 1967.
[4] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[5] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.

According to the 2005 HSA, Building 4875 was demolished in the early 1970s; however, the report does not provide a citation for this information. The building remains visible on industrial planning maps until 1973 and is removed from maps in 1975.[1,2,3]

Information from Interviewees: There have been no interviews conducted to date regarding Building 4875.

Radiological Incident Reports: None found.

Current Use: As indicated above, the 2005 HSA stated that Building 4874 was demolished in the early 1970s. Aerial photographs from 1972 do not provide enough detail to determine whether the facility has been demolished; however by 1978, it is clear the facility has been removed and concrete pads remain.[4,5] The site is currently vegetated (Figure 2.3.8.a).

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): In 1988, Rocketdyne performed a radiological survey at Building 4375 and the surrounding area to determine if any residual contamination existed. The radiation measurements taken during the survey were compared against the DOE residual radioactivity limits specified in "Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites." The maximum acceptable contamination limits used in 1988 are presented in Section 2.2.5, above.

According to the 1988 radiological survey, the Building 4375 survey included a survey of the gamma exposure rate of the grounds from J to L Streets and from 24th to 22nd Streets, including the former location of Building 4875. Seventy-nine gamma exposure rate measurements were taken surrounding Building 4375. The report indicated that no soil samples were collected because there was no indication of contamination as a result of the gamma exposure rate measurements. As indicated above, the measured ambient gamma limit was < 5 μR/hr above background, which was measured to be between 14 and 16 μR/hr.[6] The maximum measured ambient gamma surrounding Building 4375 was 13.7 μR/hr. The survey concluded that survey results were below the Rocketdyne 1988 acceptable limits and no further inspection was required at Building 4375, including Building 4875.[7]

As reported in the Area IV Radiological Characterization Survey, the area was included in the survey conducted in 1994 and 1995. Located in the central portion of survey block H12, the Building 4875 area ambient gamma survey result measured between 13.0 and 16.2 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Building 4875 area were found to be below the then-acceptable limits.[8,1]

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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.
[2] Atomics International, Nuclear Development Field Laboratories, March 1973.
[3] Atomics International, Nuclear Development Field Laboratories, March 1975.
[4] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 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.
[6] According to the 1988 survey report, an average of 38 background measurements were taken at three locations at the SSFL – the Building 4309 area, Well #13 Road, and Incinerator Road.
[7] ETEC, Document No. GEN-ZR-0012, *Radiological Survey of Buildings T373 and T375*, August 8, 1988.
[8] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.

Radiological Use Authorizations: Based on the review of currently available documents, there was no radiological use authorization associated with the operations at Building 4875.

Former Radiological Burial or Disposal Locations: None.

Aerial Photographs: In 1952, the area comprising the future Building 4875 is agricultural farmland. By 1957, the area has become developed with the construction of a building, Building 4363, South of Building 4875. In 1959, the Building 4375 area has been developed and the building structure is visible. The aerial photographs marked 1962/1963 in the aerial photograph interpretation clearly show Building 4875 to the west of Building 4375; however, few additional features are visible as a result of the increased site development.[2] The site appears to be unchanged through 1967 with the appearance of dark-toned material to the north of Building 4874. Limited detail is visible in the 1972 aerial photographs; however, it appears there are construction activities to the east of the Building 4375 area in the future location of Buildings 4473 and 4863. Beginning in 1978, the Building 4875 structure is no longer visible and a concrete pad remains. The aerial photograph interpretation begins to refer to the area as process area 5. Stains, as well as probable storage tanks are visible in this area, comprising Buildings 4363, 4873, 4875, 4375, 4874, 4473, and 4863. A stain is clearly visible to the east of Building 4375 in May 1978. The area to the east of Building 4375 appears to be an area of increased activity. This area continues to contain more materials in subsequent photographs until 1995 when the area, according to the aerial photograph interpretation, appears to be abandoned. By 2003, all structures related to process area 5 have been removed from the location, and by 2005, the area is vegetated.[3]

Radionuclides of Concern: Available documents do not provide information to indicate that high activity radioactive materials were used or stored at Building 4875. As indicated above, Building 4875 was used to support the SNAP program, but does not appear to have been involved in nuclear work. Building 4875 was demolished in the 1970s; however, Building 4375 and surrounding area appears in aerial photographs to have remained active until approximately 1995.[4] After the building area was abandoned, barrels that may have contained radioactive material were stored in the surrounding area; however, information regarding these barrels could not be located.

Drainage Pathways: According to a 1958 engineering drawing, a drainage ditch was located to the east of the Building 4375 and Building 4875 area. The drawing depicted a 4-inch drain line that originated from a drain tank pit near the southeast corner of Building 4375 and terminated at an “existing drainage ditch.”[5] Currently, surface water in the vicinity of former Building 4875 drains to the south-southeast to former L Street, then east until former L Street ends, where it then flows southeast into Area III.

[1] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.
[2] The date of the 1962/1963 aerial photographs has been determined to be approximately 1960 plus or minus a year however, the research team will continue to use the dates as they are marked on the aerial photograph figures in the attached report.
[3] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[4] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[5] Atomics International, Drawing 303-375-C1, *Drain Tank Pit and 15HP Pump Installation Bldg #375 Area*, April 4, 1958.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4875 area is Class 2, due to the unknown nature of its operations in support of the SNAP program and its proximity to Building 4055.

Recommended Locations for Soil/Sediment Sampling: It is recommended this area be evaluated for sampling as part of Building 4375, discussed above.

2.3.9 Building 4473 Area

Note: The 2005 HSA provided very limited information regarding the Building 4473 area, and limited information was available in historical documents and environmental documents received, to date. The following information was cited as having been obtained from a 2003 personnel interview with Dan Trippeda in the 2005 HSA. To date, the research team has not received the transcript of this interview, and, as a result, is presenting information as it has been provided in the 2005 HSA. Requests for additional information regarding Building 4473 are pending. Any new information obtained as a result of these requests will be incorporated into subsequent drafts of the HSA-5D TM.

Site Description: The Building 4473 area includes Building 4473 and the surrounding area located between J and K Street north of Building 4863, discussed below. The building appears to have been under construction in 1972 based on aerial photographs, and was fully constructed by 1978.[1] The building also first appears in the 1972 Atomics International industrial planning map.[2] Figures 2.3.9a through 2.3.9b provide a current photograph and historical photographs of the facility. Plate 1 presents a summary of all identified features for this site.

Building Features: Limited information regarding Building 4473 could be located. The building was part of an extended facility that included Building 4863 and a test stand pad that measured 84 by 66 feet. The test stand pad, according to a fire preplan, comprised a hydraulic test stand, cooling towers, electrical pumps, gaseous nitrogen, electrical substation, offices, control room with computers, liquid storage vessels, and a crane. Building 4473 measured 144 square feet and was constructed of steel with a corrugated steel roof.[3] Undated photographs show an unidentified number of tanks surrounding Buildings 4473 and 4863 (see Figure 2.3.9b).

Former Use(s): Building 4473 is first identified in 1972 Atomic International industrial planning maps as a hydraulic test instrumentation building.[4] As indicated above, the 2005 HSA presented information regarding this facility based on information provided by Dan Trippeda during a September 18, 2003, personnel interview.[5] According to Mr. Trippeda, Building 4473 was part of the Hydraulic Test Facility that was used to conduct preliminary tests on piping, pumps and other loop components. The test facility used water because it has a similar flow rate to liquid sodium. According to Mr. Trippeda, the tests were designed so the researchers could

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] Atomics International, Industrial Planning Map Nuclear Development Field Laboratories, May 1972.
[3] Author Unknown, *Fire Preplan – Building 863 Test Stand*, Undated.
[4] Atomics International, Industrial Planning Map Nuclear Development Field Laboratories, May 1972.
[5] Because the research team has not yet received the interview transcript from the 2003 interview, the information presented is paraphrased from information contained in the 2005 HSA.

examine descriptors such as fatigue rates and results such as fracturing of components. Building 4473 served as the control center for the Hydraulic Test Loop (Building 4863).[1]

Based on industrial planning maps, prior to May 1982, the building was identified as a Rockwell-owned facility. In the May 1982 planning map, the hydraulic test facility, including Buildings 4473 and 4863 are located in an area identified as a "government option boundary" and the ownership of the building is noted as being that of the Government. The facility remains to be identified as a hydraulic test instrumentation building.[2] The facility remains to be identified as a Government facility through 1992, with the 1987 map identifying the area as "inducer pump test."[3,4]

Mr. Trippeda was summarized in the 2005 HSA has having said that Building 4473 was demolished in 2003.[5] Aerial photographs also indicate the area comprising Building 4473 and the surrounding buildings were cleared from Area IV in 2003.[6]

Information from Interviewees: There have been no interviews conducted to date regarding Building 4473, with the exception of the personnel interview of Dan Trippeda on September 18, 2003. The research team is in the process of obtaining the transcript from this interview.

Radiological Incident Reports: There have been no radiological incident reports identified for Building 4473.

Current Use: As indicated above, according to Mr. Trippeda, Building 4473 was demolished in 2003.[7]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4473 have not been conducted; however, according to the Area IV Radiological Characterization Survey, the area was included in the survey conducted in 1994 and 1995. Located in the central portion of survey block H13, the Building 4473 area ambient gamma survey result measured between 7.8 and 16.0 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Building 4473 area were found to be below the then-acceptable limits.[8,9]

[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. Citing Personnel Interview, Dan Trippeda, September 18, 2003.
[2] Energy Systems Group, Industrial Planning Map Santa Susana Field Laboratory, May 1982.
[3] ETEC, Drawing No. M000-68347-01, Santa Susana Field Laboratory ETEC Site Development Map, February 12, 1987.
[4] ETEC, Drawing No. GEN-CA-0001, SSFL Area IV Site Map, November 11, 1992.
[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. Citing Personnel Interview, Dan Trippeda, September 18, 2003.
[6] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[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. Citing Personnel Interview, Dan Trippeda, September 18, 2003.
[8] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.
[9] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.

Radiological Use Authorizations: There have been no use authorizations identified for Building 4473.

Former Radiological Burial or Disposal Locations: As indicated above, Building 4473 was located in the former location of the Building 4363 leach field. This leach field is not associated with any operations in Building 4473.

Aerial Photographs: In 1952, the area comprising the future Building 4473 is agricultural farmland. The 1957 area photographs shows a linear ground scar leading just north of the future Building 4473 area to the intersection of 22nd and L Street. This ground scar appears to correspond to a drainage channel referenced in Building 4375 construction drawings. The area remains undeveloped until 1972 aerial photographs with the appearance of construction activities to the east of the Building 4375 area in the future location of Buildings 4473 and 4863. Beginning in 1978, the aerial photograph interpretation begins to refer to the area as process area 5. Stains, as well as probable storage tanks are visible in this area, comprising Buildings 4363, 4873, 4875, 4375, 4874, 4473, and 4863. The area to the west of Building 4473 appears to be an area of increased activity. This area continues to contain more materials in subsequent photographs until 1995 when the area, according to the aerial photograph interpretation, appears to be abandoned. By 2003, all structures related to process area 5 have been removed from the location, and by 2005, the area is vegetated.[1]

Radionuclides of Concern: Based on the limited historical information available, it does not appear radionuclides were used at Building 4473.

Drainage Pathways: Aerial photographs appear to show the establishment of a drainage channel in the vicinity of the Building 4473 area in 1957. The drainage channel extended to the north of Building 4473, eastward to the intersections of L and 22nd Streets. Currently, surface water in the vicinity of former Building 4473 drains to the south-southeast into the ditch on the north side of former L Street, then east until former L Street ends, where it then flows southeast into Area III

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4473 area is Class 3 because the likeliness of radiological contamination as a result of building operations is low based on available information.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4473 area. Very limited information regarding the operations of Building 4473 have been located, to date. Significant information regarding the disposal and demolition of the building is lacking.

There have been no previous characterization studies for the Building 4473 area. Therefore, additional characterization is recommended for the Building 4473 area. This includes the following Building 4473 areas and appurtenances:

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

- The former Building 4473 location. Limited information is available regarding the building's operations. The area comprising the Building 4473 area included numerous above ground storage tanks.

2.3.10 Building 4863 Area

Site Description: The Building 4863 area includes Building 4863 and the surrounding area south of J Street, and northeast of the Building 4363 area. Building 4863 was part of the hydraulic test facility and appears to have been constructed in the vicinity of the former Building 4363 leach field, or slightly to the east of it.[1] Figure 2.3.10a provides a current photograph of the facility, and Figure 2.3.10b provides a series of undated photographs of the facility. Plate 1 presents a summary of all identified features for this site.

Building Features: Constructed in approximately 1971, Building 4863 was a 396-square foot facility. According to the 1987 site consolidation report, the building was an open test stand structure.[2] The frame, siding, and roof of the facility were steel and were anchored to a concrete pad. The building was elevated approximately 30 feet off the ground level and was accessed by a steel stairway on the west side. The building was part of an extended facility that included Building 4473 and a test stand pad that measured 84 by 66 feet. The test stand pad, according to a fire preplan, comprised a hydraulic test stand, cooling towers, electrical pumps, gaseous nitrogen, electrical substation, offices, control room with computers, liquid storage vessels, and a crane.[3] In addition, the hydraulic test facility included five storage tanks (Tanks T-1, T-5, T-12, T-156, and an unnumbered tank) that each contained deionized water. The tanks had a total capacity of 37,000 gallons.[4] A map showing the locations of each of these tanks was not located.

Former Use(s): Building 4863 is first identified in 1972 Atomic International industrial planning maps as a hydraulic test loop building.[5] The 2005 HSA presented information regarding this facility based on information provided by Dan Trippeda during a September 18, 2003, personnel interview.[6] According to Mr. Trippeda, Building 4863 was part of the Hydraulic Test Facility that was used to conduct preliminary tests on piping, pumps and other loop components. The test facility used water because it has a similar flow rate to liquid sodium. According to Mr. Trippeda, the tests were designed so the researchers could examine descriptors such as fatigue rates and results such as fracturing of components. Building 4863 served as the experimental test loop.[7]

Based on industrial planning maps, prior to May 1982, the building was identified as a Rockwell-owned facility. In the May 1982 planning map, the hydraulic test facility, including Buildings 4863 and 4473 are located in an area identified as a "government option boundary"

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[1] Atomics International, Drawing No. 303-GEN-C18, *Central Sewage System Plan & Topography*, August 27, 1959.
[2] Stafford, K.T., ETEC, *Site Consolidation Assessment*, April 16, 1987.
[3] Author Unknown, *Fire Preplan – Building 863 Test Stand*, Undated.
[4] Tavasoli, K., Rockwell International Internal Letter Re: SSFL Aboveground Storage Tank/Pressure Vessel Inspection, May 18, 1993.
[5] Atomics International, Industrial Planning Map Nuclear Development Field Laboratories, May 1972.
[6] Because the research team has not yet received the interview transcript from the 2003 interview, the information presented is paraphrased from information contained in the 2005 HSA.
[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. Citing Personnel Interview, Dan Trippeda, September 18, 2003.

and the ownership of the building is noted as being that of the Government. The facility remains to be identified as a hydraulic test loop.[1] The facility remains to be identified as a Government facility through 1992.[2,3]

According to a 1992 NEPA compliance activities status report included in the 1992 annual site environmental report, Building 4863 was placed on "inactive standby facility maintenance" on September 29, 1992; however, additional information regarding the maintenance operations required could not be located in the documents received.[4] Mr. Trippeda was summarized in the 2005 HSA has having said that Building 4863 was demolished in 2003.[5] Aerial photographs also indicate the area comprising Building 4863 and the surrounding buildings were cleared from Area IV in 2003.[6]

Information from Interviewees: There have been no interviews conducted to date regarding Building 4863, with the exception of the personnel interview of Dan Trippeda on September 18, 2003. The research team is in the process of obtaining the transcript from this interview.

Radiological Incident Reports: There have been no radiological incident reports identified for Building 4863.

Current Use: As indicated above, according to Mr. Trippeda, Building 4863 was demolished in 2003.[7]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4863 have not been conducted; however, according to the Area IV Radiological Characterization Survey, the area was included in the survey conducted in 1994 and 1995. Located in the southwest corner of survey block H13, the Building 4863 area ambient gamma survey result measured between 6.0 and 12.2 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Building 4863 area were found to be below the then-acceptable limits.[8,9]

Radiological Use Authorizations: There have been no use authorizations identified for Building 4863.

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[1] Energy Systems Group, Industrial Planning Map Santa Susana Field Laboratory, May 1982.
[2] ETEC, Drawing No. M000-68347-01, Santa Susana Field Laboratory ETEC Site Development Map, February 12, 1987.
[3] ETEC, Drawing No. GEN-CA-0001, SSFL Area IV Site Map, November 11, 1992.
[4] Rockwell International, Document No. RI/RD93-125, *Rocketdyne Division Annual Site Environmental Report* 1992, December 14, 1993.
[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. Citing Personnel Interview, Dan Trippeda, September 18, 2003.
[6] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[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. Citing Personnel Interview, Dan Trippeda, September 18, 2003.
[8] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.
[9] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.

Former Radiological Burial or Disposal Locations: Like Building 4473, Building 4863 was located in the former location of the Building 4363 leach field. This leach field is not associated with any operations in Building 4863.

Aerial Photographs: In 1952, the area comprising the future Building 4863 is agricultural farmland. The 1957 area photographs shows a linear ground scar leading just north of the future Building 4473 and 4863 area eastward to the intersection of 22nd and L Street. This ground scar appears to correspond to a drainage channel referenced in Building 4375 construction drawings. The area remains undeveloped until 1972 aerial photographs with the appearance of construction activities to the east of the Building 4375 area in the future location of Buildings 4863 and 4473. Beginning in 1978, the aerial photograph interpretation begins to refer to the area as process area 5. Stains, as well as probable storage tanks are visible in this area, comprising Buildings 4363, 4873, 4875, 4375, 4874, 4473, and 4863. The area to the west of Building 4863 appears to be an area of increased activity. This area continues to contain more materials in subsequent photographs until 1995 when the area, according to the aerial photograph interpretation, appears to be abandoned. By 2003, all structures related to process area 5 have been removed from the location, and by 2005, the area is vegetated.[1]

Radionuclides of Concern: Based on the limited historical information available, it does not appear radionuclides were used at Building 4863.

Drainage Pathways: Aerial photographs appear to show the establishment of a drainage channel in the vicinity of the Building 4863 area in 1957. The drainage channel extended to the north of Buildings 4863 and 4473, eastward to the intersections of L and 22nd Streets. Currently, surface water in the vicinity of former Building 4863 flows to the south-southeast into the ditch on the north side of former L Street, then east until former L Street ends, where it then flows southeast into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4863 area is Class 3 because the likeliness of radiological contamination as a result of building operations is low based on available information.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4863 area. Very limited information regarding the operations of Building 4863 has been located, to date. Significant information regarding the disposal and demolition of the building is lacking.

There have been no previous characterization studies for the Building 4863 area. Therefore, additional characterization is recommended for the Building 4863 area. This includes the following Building 4863 areas and appurtenances:

- The former Building 4863 location. Limited information is available regarding the building's operations. The area comprising the Building 4863 area included numerous above ground storage tanks.

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.

2.3.11 Building 4873 Area

Site Description: The Building 4873 area comprises Building 4873 and the surrounding area just north of Building 4363 at the northeast corner of 24th and L Streets. This building was located outside the boundaries of the U.S. Government-optioned land at the SSFL Site. Building 4873 appears to have been constructed prior to 1958 as an "Installation of OMR Mock-Up Fuel Handling."[1,2] Figures 2.3.11a through 2.3.11e 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: There is limited available information regarding the features of Building 4873. According to an undated Atomics International drawing of the bridge and index arrangement of the building, and a 1958 aerial oblique photograph of the area, the building appears to have been a tall open steel structure (see Figure 2.3.11d) located just north of Building 4363.[3,4] Additionally, aerial photographs appear to show the building to have been connected by aboveground pipelines to Building 4363.[5] The purpose of these pipelines is unknown.

Former Use(s): The 2005 HSA presented information regarding this facility based on information provided by Phil Rutherford and Del Aubuchon during September 18, 2003, personnel interviews.[6] According to the Mr. Rutherford and Mr. Aubuchon, Building 4873 served as part of the hydraulic test facility as the hydraulic test laboratory and was where the engineers established the parameters of the experiments. The building was part of the Hydraulic Test Facility that was used to conduct preliminary tests on piping, pumps and other loop components. The test facility used water because it has a similar flow rate to liquid sodium.[7]

An undated drawing identifies this facility as an "Installation of OMR Mock-Up Fuel Handling," and this facility appears to have been constructed prior to 1958.[8,9] The March 15, 1962, industrial planning map refers to "873" as a "pad at Bldg 363." In 1967, the building is labeled as a "fuel rod test tower and pad." By 1971, industrial planning maps identify the building as a hydraulic test lab and it remains identified as such through 1991, the last available ETEC site map. Unlike Buildings 4473 and 4863, discussed above, Building 4873 was owned by Rockwell during its entire operational period.[10,11,12,13]

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[1] Atomics International, Drawing No. 303-873-S5, *Installation of OMR Mock-Up Fuel Handling Bridge and Index Arrangement #875*, Date Illegible.
[2] Unknown Photographer, Aerial Oblique Photograph of SSFL dated November 11, 1958
[3] Atomics International, Drawing No. 303-873-S5, *Installation of OMR Mock-Up Fuel Handling Bridge and Index Arrangement #875*, Date Illegible.
[4] Unknown Photographer, Aerial Oblique Photograph of SSFL dated November 11, 1958
[5] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[6] Because the research team has not yet received the interview transcript from the 2003 interviews, the information presented is paraphrased from information contained in the 2005 HSA.
[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. Citing Personnel Interview, Del Aubuchon, September 18, 2003, and Personnel Interview, Phil Rutherford, September 18, 2003.
[8] Atomics International, Drawing No. 303-873-S5, *Installation of OMR Mock-Up Fuel Handling Bridge and Index Arrangement #875*, Date Illegible.
[9] Unknown Photographer, Aerial Oblique Photograph of SSFL dated November 11, 1958
[10] Atomics International, Nuclear Development Field Laboratories, Industrial Planning, March 15, 1962.
[11] Atomics International, Nuclear Development Field Laboratories, January 1, 1967.
[12] Atomics International, Nuclear Development Field Laboratories, April 1, 1971.
[13] Rockwell International, Drawing No. GEN-CA-0001, ETEC Site Map, February 19, 1991.

Information from Interviewees: There have been no interviews conducted to date regarding Building 4873, with the exception of the personnel interviews of Dan Trippeda, Phil Rutherford, and Del Aubuchon on September 18, 2003. The research team is in the process of obtaining the transcript from these interviews.

Radiological Incident Reports: There have been no radiological incident reports identified for Building 4873.

Current Use: According to Mr. Trippeda, Building 4873 was demolished in 2003; however, available documents that have been reviewed have not provided a final demolition date.[1] A November 15, 2000, addendum to the demolition contract noted that the demolition of Building 4873 included the removal of an 8-inch municipal water line located on the north side of the Building 4873 foundation. The line was to be removed to the point of intersection with a concrete pad and/or road.[2] In September 2001, the removal was further modified to include the construction of an access vault at the water shutoff valve to allow future access. It was estimated that there was 125 linear feet of underground water piping.[3]

Previous Radiological Investigation(s) and Decontamination/Cleanup of Release(s): Radiological surveys specific to Building 4873 have not been conducted; however, according to the Area IV Radiological Characterization Survey, the area was included in the survey conducted in 1994 and 1995. Located in the southern portion of survey block H12, the Building 4873 area ambient gamma survey result measured between 11.0 and 16.1 μR/hr. The survey found background to be 15.6 μR/hr, and the acceptable limit was identified by Rocketdyne as being less than 5 μR/hr above background. Accordingly, survey results in the vicinity of the Building 4873 area were found to be below the then-acceptable limits.[4,5]

Radiological Use Authorizations: There is no evidence to indicate the operations in Building 4873 were authorized by any use authorizations.

Former Radiological Burial or Disposal Locations: There are no radiological burial or disposal locations identified at Building 4873.

Aerial Photographs: In 1952, the area comprising the future Building 4873 area is agricultural land. By 1957, two buildings have been constructed in the Building 4873 area, including Building 4363 and what appears to be an elevated pad in the location of Building 4873. In August 1959, Building 4873 appears to be more developed with a larger structure being present. 1962/1963 photographs appear to show the presence of possible overhead pipelines connecting Building 4873 with Building 4363. Beginning in 1978, the aerial photograph interpretation begins to refer to the area as process area 5. Stains, as well as probable storage tanks are visible in this area, comprising Buildings 4363, 4873, 4875, 4375, 4874, 4473, and 4863. This area

[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. Citing Personnel Interview, Dan Trippeda, September 18, 2003.
[2] Boeing, *Building(s) 4363, 4375, and 4873 Addendum to Demolition Contract*, November 15, 2000.
[3] Boeing, *Building(s) 4353, 4363, 4375 and 4873 Addendum to Demolition Contract*, September 4, 2001.
[4] Rocketdyne Document A4CM-ZR-0011, Rev. A, *Area IV Radiological Characterization Survey*, August 15, 1996.
[5] Boeing, Document No. N001SRR140131, *Approved Sitewide Release Criteria for Remediation of Radiological Facility at the SSFL*, February 18, 1999.

remained active through the early 1990s. In 1995 the area appears to no longer be active, and the Building 4873 structure no longer appears to be present. By 2003 all structures related to this processing area have been removed. By 2005 the former Building 4873 area is vegetated.[1]

Radionuclides of Concern: Based on the limited historical information available, it does not appear radionuclides were used at Building 4873.

Drainage Pathways: 1957 site drawings and plot plans show a drainage ditch beginning at the southwest corner of the building, then flowing north along the west end of the building, then flowing east along the northern boundary of the building to an area east of the building where the drawing indicates that the ditch should be run "so drainage will discharge to south of building."[2] (See Figure 2.3.11e.) Currently, surface water within the vicinity of former Building 4873 drains to the southeast into the ditch on the north side of former L Street. Surface water then runs east along former L Street till it dead ends, where it then flows southeast into Area III.

Radiological Contamination Potential: The preliminary MARSSIM Classification for the Building 4873 is Class 2 based on limited available historical information and the proximity of the building to Building 4363.

Recommended Locations for Soil/Sediment Sampling: Plate 1 and Figure 2.3 provide a convenient reference for the following recommendations.

Based on the available information, soil sampling is recommended in the Building 4873 area. Very limited information regarding the operations of Building 4873 has been located, to date. Significant information regarding the disposal and demolition of the building is lacking.

There have been no previous characterization studies for the Building 4873 area. Therefore, additional characterization is recommended for the Building 4873 area. This includes the following Building 4873 areas and appurtenances:

- The former Building 4873 location. Limited information is available regarding the building's operations. Based on aerial photographs, the building was an open steel structure and included possible above ground pipelines that were connected to Building 4363. The purpose of the pipelines could not be determined from available documents.

2.4 GROUP 4

The Group 4 index map is presented in Figure 2.4. Group 4 includes is located in HSA-5D South and includes two water storage tanks (Tank 4701 and 4702) and the borrow area. Limited information is available regarding these areas.

Tank 4701 and Tank 4702

Tanks 4701 and 4702 are located on the ridgeline along the southern edge of Area IV. The tanks have been used to store water for use at the SSFL. Facility drawings show that waterlines to

[1] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[2] Atomics International, Drawing No. 303-363-C13, *Grading and Plot Plan, Building 363 Remodel*, 1957.

buildings originate from the pipeline leading from the two tanks. According to the 2005 HSA, Dan Trippeda indicated that water only flowed out from the tanks. Documents could not be located to indicate how the tanks were refilled or the capacities of each tank. There have been no radiological surveys specific to Tanks 4701 or 4702 conducted, and available documents did not identify any use authorizations or incident reports relating to the tanks. Both tanks remain standing at the site.[1]

Aerial photographs show the presence of a single vertical tank on the ridgeline as early as 1957. An aboveground pipeline leads from the tank to the base of the ridge, where it appears to go underground. Ground scarring is visible from the tank to 24th Street. Beginning in 1965, a second tank is visible to the west of the first tank. This new tank is no longer visible in 1967; however a larger tank has been placed adjacent to the west side of the 1957-era tank. The site remains relatively unchanged through 2005, where the tanks remain visible.[2]

Process water used at the SSFL was obtained from wells and stored in 50,000 gallon tanks.[3]

As a result of the limited information available regarding these tanks, and their remoteness from radiologically controlled facilities, the preliminary MARSSIM Classification for Tanks 4701 and 4702 is Class 3. There are no recommended sampling locations for either of these tanks.

[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. Citing Personnel Interview, Dan Trippeda, September 18, 2003.
[2] U.S. EPA, Environmental Photographic Interpretation Center Draft Report, March 2010.
[3] Incomplete Document regarding "North American Aviation Inc., Atomics International Involvement in Atomic Energy Research and Development since 1946," Date unknown.

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 Division of North American Aviation, Inc. (Atomics International) to receive and possess 50 grams of uranium enriched in U-235 for use in fission counter tubes. License No. SNM-21 was renewed, extended, and/or 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 Commission (NRC) and License No. SNM-21 became an NRC license. License No. SNM-21 applied to contractor owned facilities, only, located outside the former ETEC boundary. Buildings 4020 and 4055, within Subarea HSA-5D, operated under License No. SNM-21.

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), which is adjacent to the HSA-5D subarea. 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 ten times before it was terminated on October 6, 1980.

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 micro curies total
Hydrogen-3	Titanium tritide foil (U.S. Nuclear Corporation)	500 mill curies
Hydrogen-3	Titanium tritide foil (U.S. Radium Corporation)	1 curie
Strontium-90	Sealed source (U.S. Nuclear Corporation Model 312)	5 micro curies
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 micro curies
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 mill curies each
Americium-241	Any	2 mill curies
Natural or depleted uranium	Any	20,000 pounds
Natural thorium	Any	700 pounds

This license is assumed to have covered the use and possession of radioactive materials in Building 4020, the Hot Laboratory, and Building 4055, the Nuclear Materials Development Lab, as well as up to four other facilities in Subarea HSA-5D that may have been involved in the use of radioactive materials. 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 micro curies
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 micro curies 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.

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 and groundwater samples are likely to have been used or generated on the SSFL.

Table 3.3
Summary of Subarea HSA-5D Sites
Radionuclides of Concern

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

Table 3.3 (continued)
Summary of Subarea HSA-5D Sites
Radionuclides of Concern

Site No.	Use(s)	Current Status	Potential Radionuclides of Concern	MARSSIM Class
4468	Holdup Tank	Demolished	U-235, U-238, Pu-238, Pu-239+240, Th-232, Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, and Tl-208. Also, H-3, Sr-90, Co-60, Cs-137, Eu-152, Am-241, and Am-243.	1
4473	Hydraulic Test Instrumentation Building	Demolished	None identified.	3
4509	Parking Lot	Demolished		2
4520	Parking Lot	Demolished	U-235, U-238, Pu-238, Pu-239+240, Th-232, Th-234, Th-228, Ac-228, Ra-226, Pb-214, Bi-214, Pb-212, Bi-212, and Tl-208. Also, H-3, Sr-90, Co-60, Cs-137, Eu-152, Am-241, and Am-243.	1
4553	Parking Lot	Demolished	None identified.	3
4575	Parking Lot	Demolished	None identified.	3
4701	Water Tank	Demolished	None identified	3
4702	Water Tank	Demolished	None identified	3
4854	Radiation Fuel Gauge Test Structure	Demolished	None identified.	2
4863	Hydraulic Test Loop	Demolished	None identified.	3
4873	Hydraulic Test Laboratory; Fuel Rod Test Tower and Pad	Demolished	None identified.	2
4874	Control Rod Test Tower and Pad	Demolished	None identified.	2
4875	Pad and Creep Loop Tower	Demolished	None identified.	2

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4.0 REACTOR/CRITICALITY FACILITIES/SIGNIFICANT SITES WORKS CITED

4.1 BUILDING 4020

Facility Name	Building No.	Period of Operation	Notes
Hot Laboratory	4020	1959–1996	

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Facility Name	Building No.	Period of Operation	Notes
Nuclear Materials Development Facility	4055	1967-1977	

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4.3 BUILDING 4373

Facility Name	Building No.	Period of Operation	Notes
SNAP Critical Facility	4373	1956 -	Critical Test Assembly

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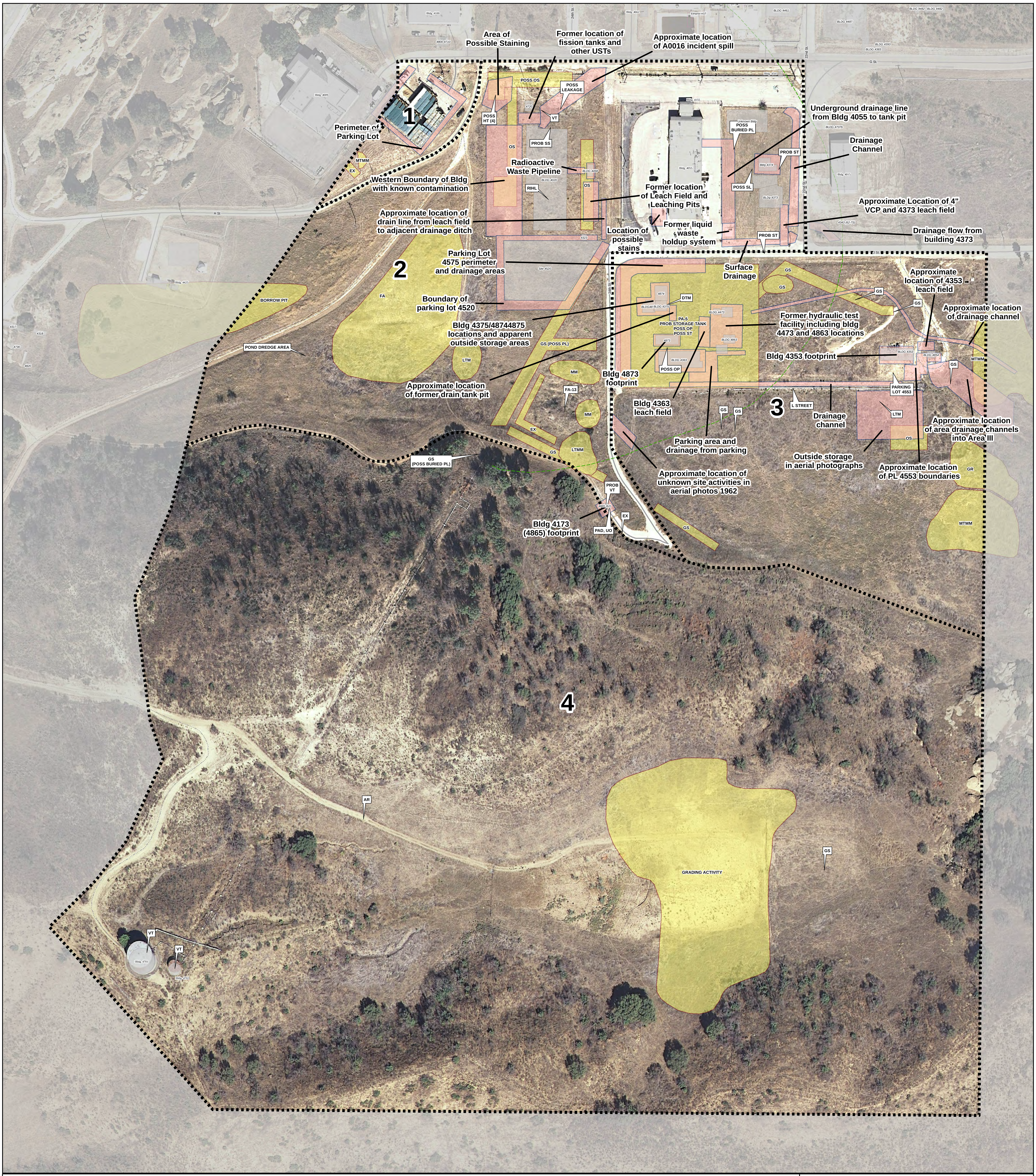

Legend

- Subarea 5D 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
- Proposed Sampling Locations

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-5D

Plate 1
Subarea HSA-5D
Santa Susana Field Laboratory

U.S. EPA Region 9

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HSA-5D_Plate1.mxd
12/1/2011 tjansen

HGL

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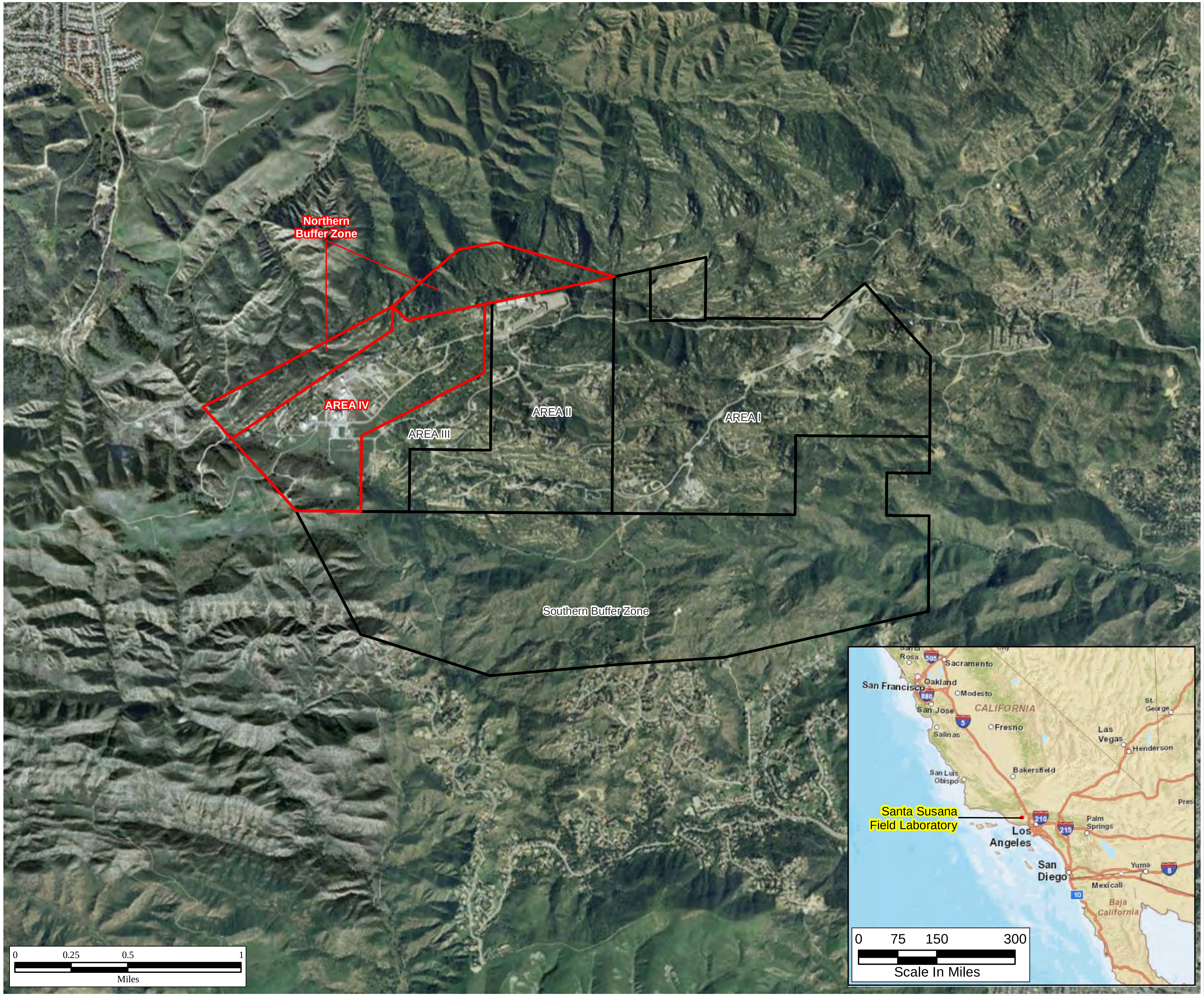
Figure 1.1
Site Location
Santa Susana Field Laboratory

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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11/22/2011 tjansen
Project: EP9038
Sorce: CaSil, NAIP 2009; Boeing 2008

HGL HydroGeoLogic, Inc

Redacted

Figure 1.2
General Site Layout for Area IV/HSA Subareas Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

HSA Subarea

Buildings

Existing

Removed

0 250 500 1000

Scale In Feet

N

Y:\Santa_Susana\EP9038\TM\HSA_5D\(1-02)site_layout.mxd
11/22/2011 tjansen
Project: EP9038
Sorce: Boeing Company, 2008
CIRGIS, 2007

HGL HydroGeoLogic, Inc

Redacted

Historical Site Assessment
Final Technical Memorandum - HSA-5D

Figure 1.3
Subarea HSA-5D
Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

Buildings

Existing
Removed
Lined Channel
Intermittent Stream*
Pipe (Unknown Type)
Surface Water Flow
Drainage Divide

*Intermittent streams also represent unlined channels.

N

0 100 200 400
Scale In Feet

Y:\Santa_Susana\EP9038\TM\HSA_5D\(1-03)subarea_HSA_5D.mxd
11/22/2011 tjansen
Project: EP9038
Source:Boeing Company, 2008
CIRGIS, 2007

Redacted

Historical Site Assessment
Final Technical Memorandum - HSA-5D

Figure 2.1
Area IV Subarea 5D-1
Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

- Subarea 5D-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

Aerial Photo Features

- Aerial Photography Features
- Proposed Sampling Locations
- 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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12/1/2011 tjansen
Sorce: Boeing Company, 2008
CIRGIS, 2007

HGL HydroGeoLogic, Inc.

Redacted

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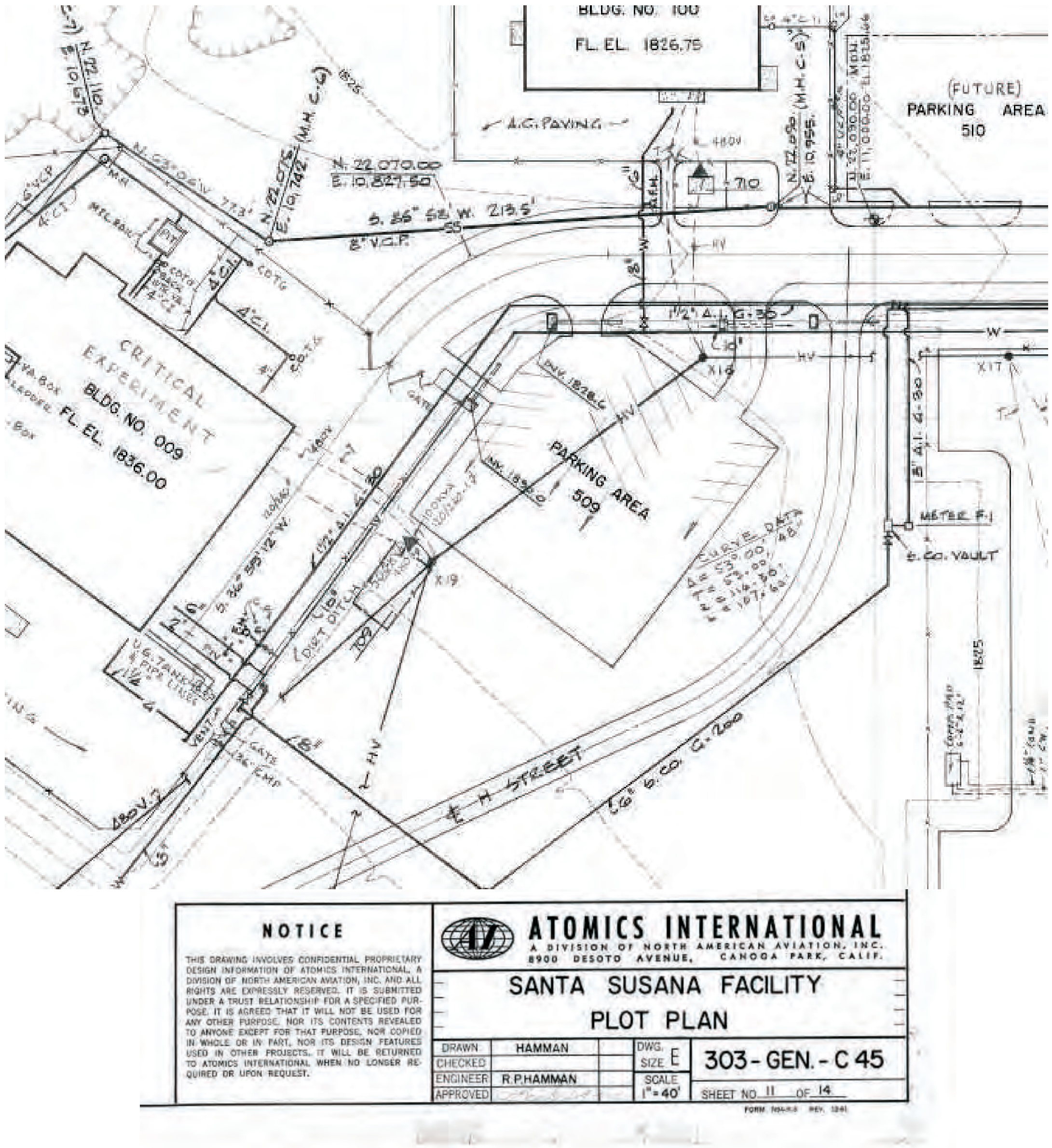
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.1a
Parking Lot 4509
Site Photograph

Redacted



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Revised: 03/21/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.1b
Parking Lot 4509
Plot Plan

Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
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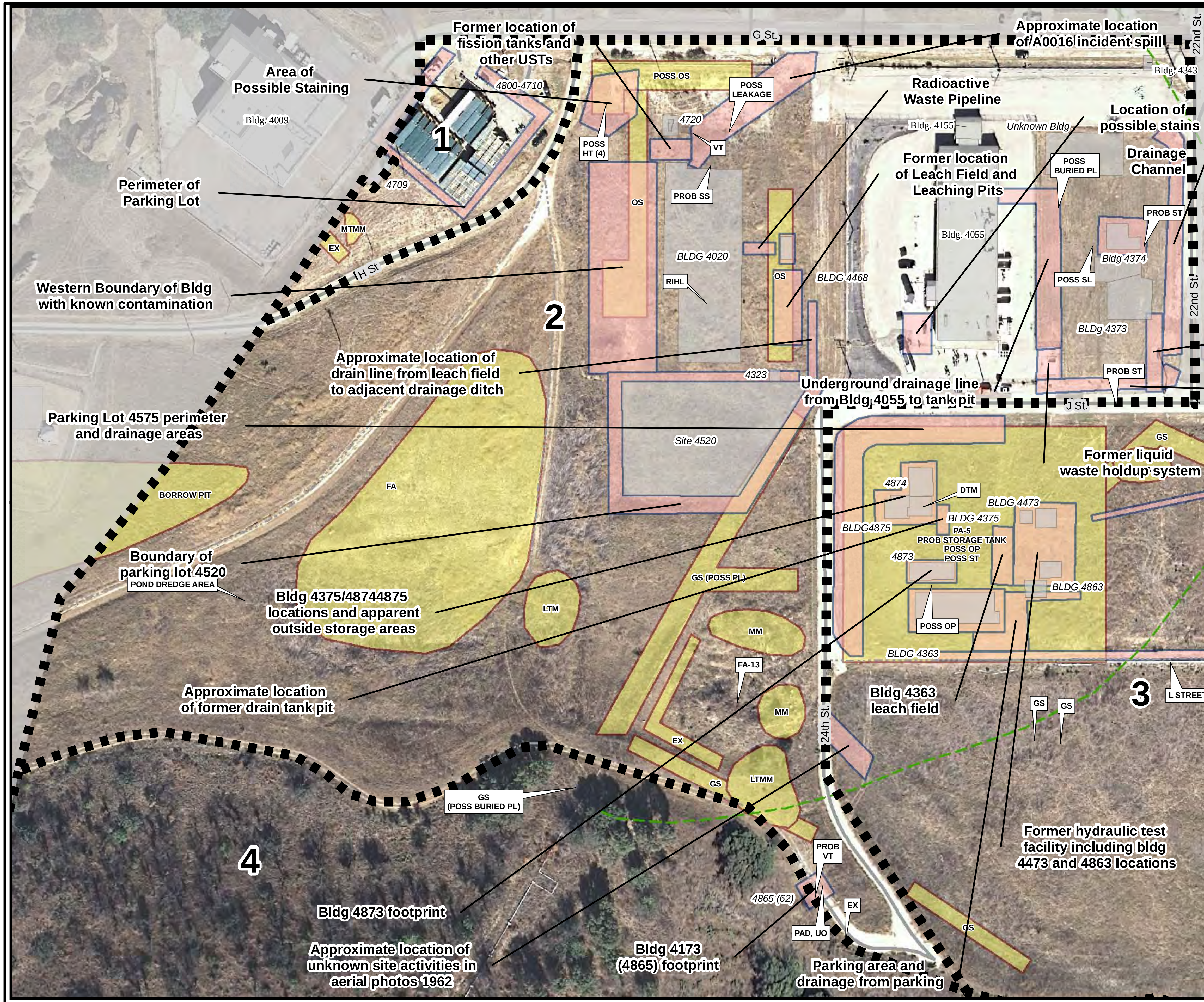
Project:EP9038
Revised: 03/21/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.1.1c
Parking Lot 4509
Undated Aerial Oblique

Redacted



Historical Site Assessment
Final Technical Memorandum - HSA-5D

Figure 2.2
Area IV Subarea 5D-2
Santa Susana Field Laboratory

U.S. EPA Region 9

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Legend

- Subarea 5D-2 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
- Proposed Sampling Locations
- 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

N

0 25 50 100
Scale In Feet

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12/1/2011 tjansen
Sorce: Boeing Company, 2008
CIRGIS, 2007

HGL HydroGeoLogic, Inc

Redacted

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(2-2-1a)Bldg4020SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008*

U.S. EPA Region 9

**Figure 2.2.1a
Building 4020
Site Photograph**

Redacted

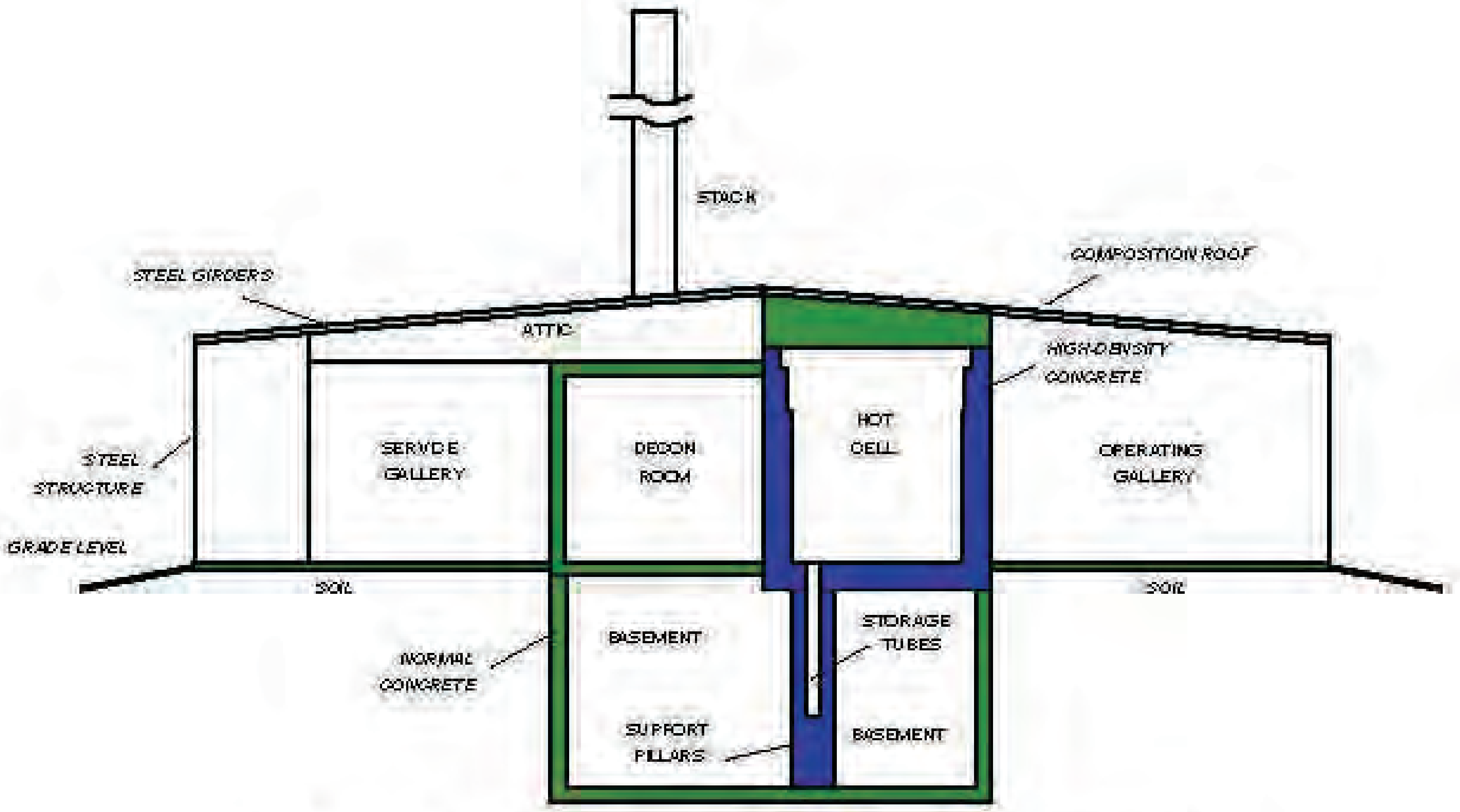

Figure 2-2. Elevation View of Building 4020, Showing the Geometry of the Hot Cells, Decon Rooms, and Basement.

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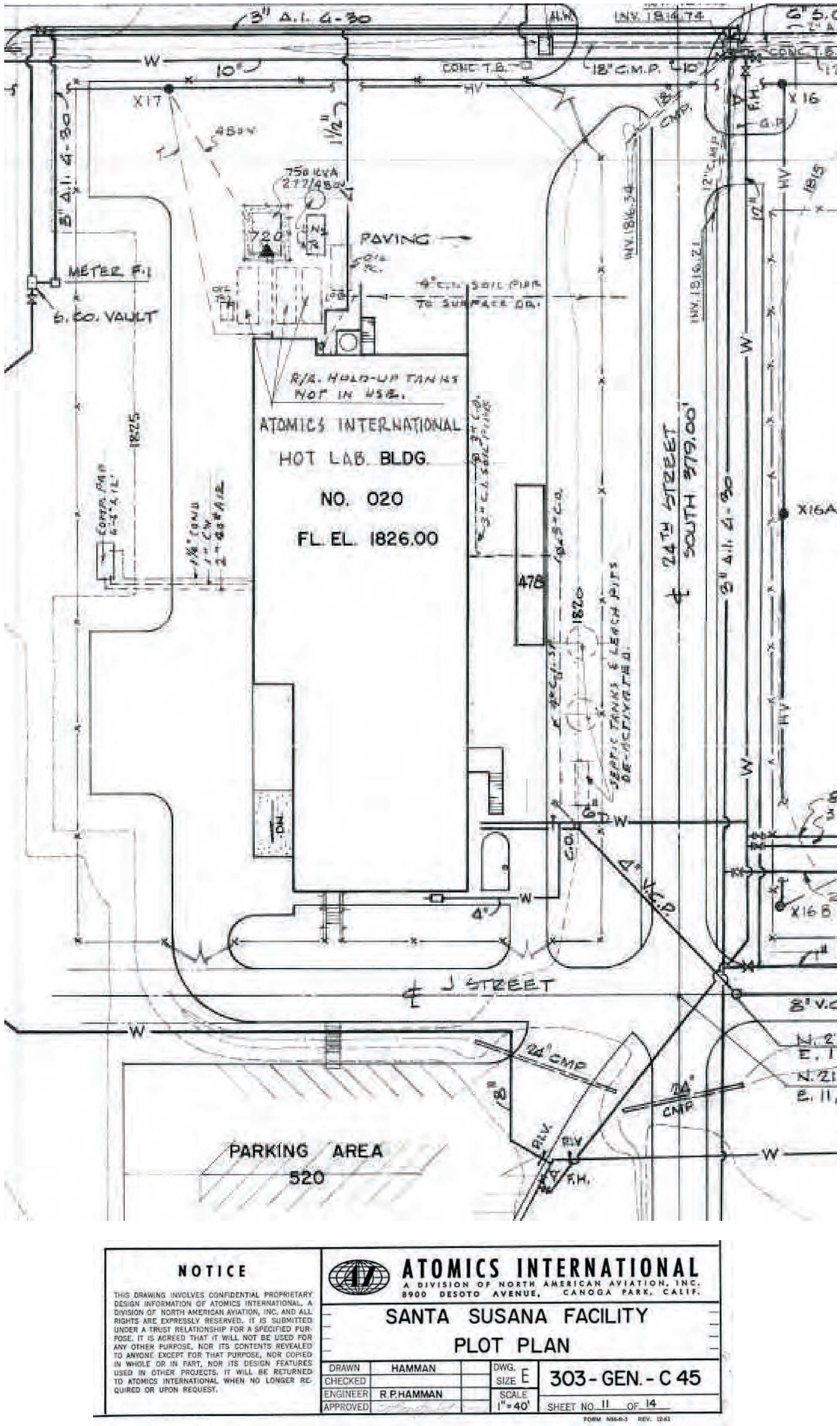
Project:EP9038
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1b
Building 4020
Elevation View



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Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1c
Building 4020
Plot Plan

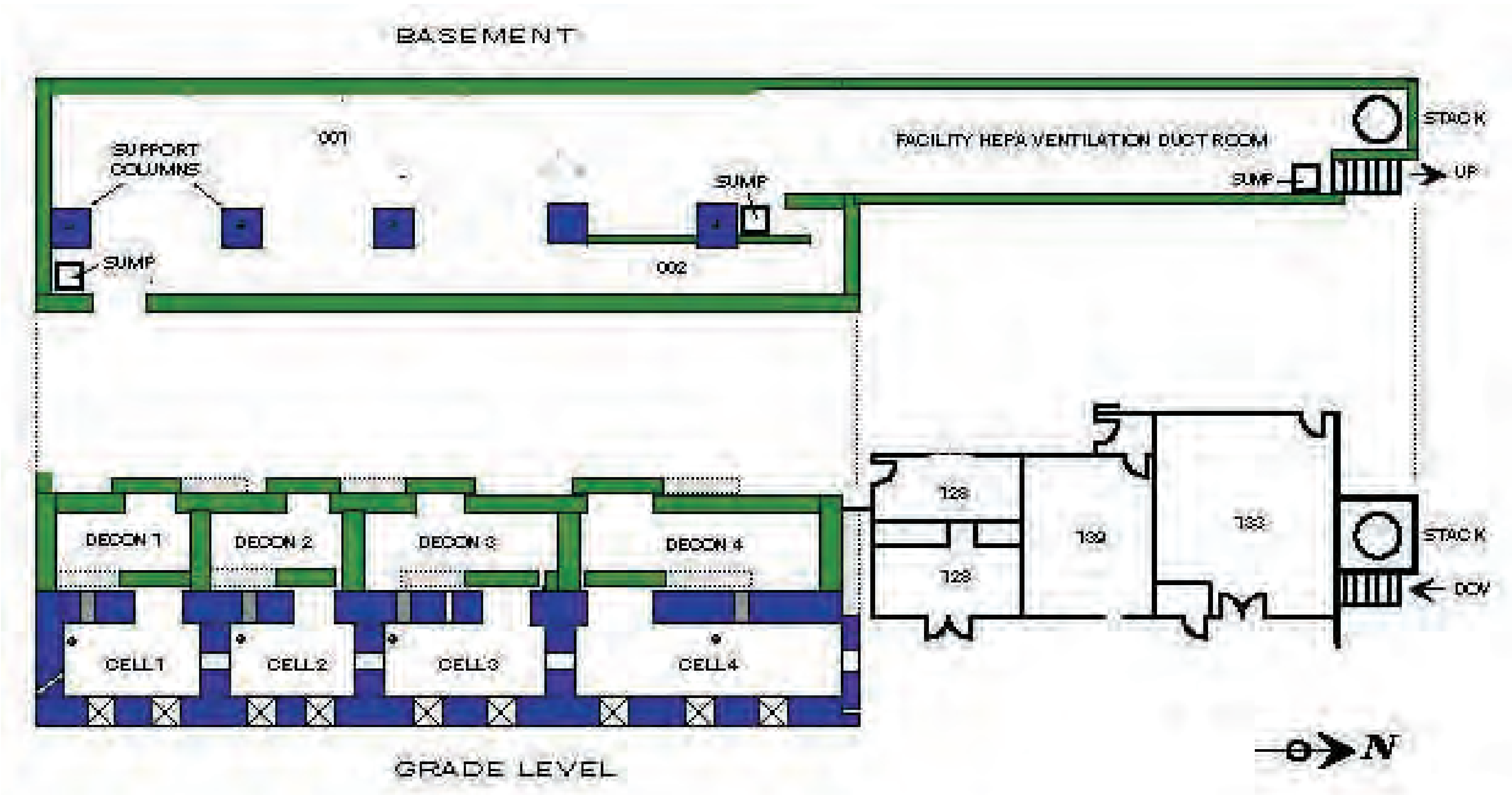

Figure 2-4. Plan View of the Building 4020 Basement, Shown Relative to the Hot Cells and Decon Room.

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Project:EP9038
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

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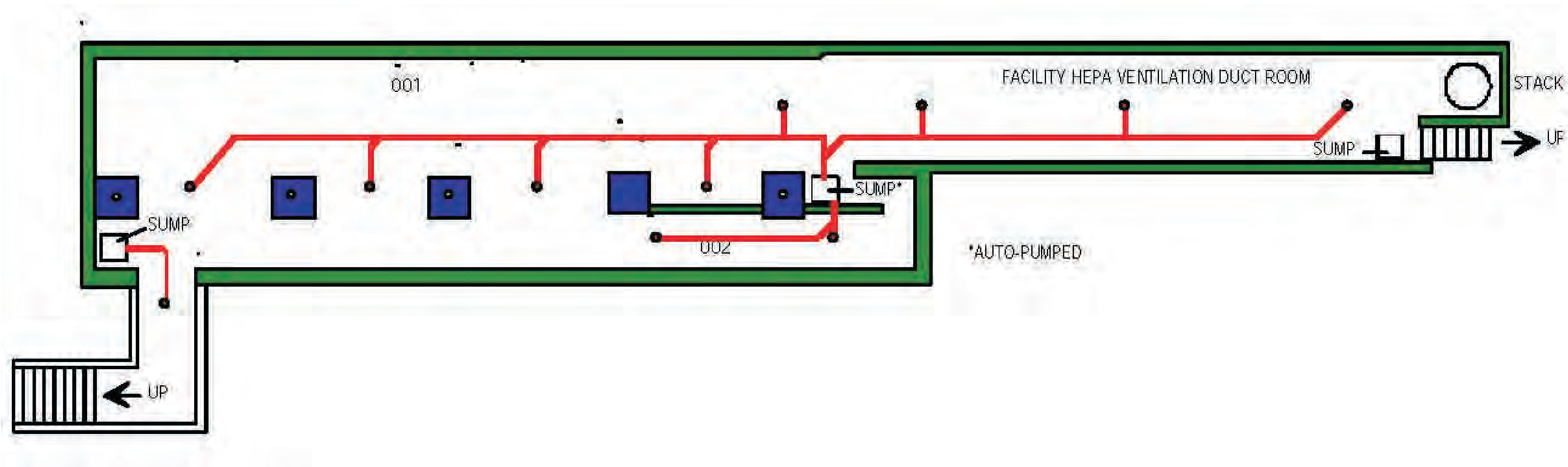
Figure 2.2.1d
Building 4020
Basement Plan



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Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

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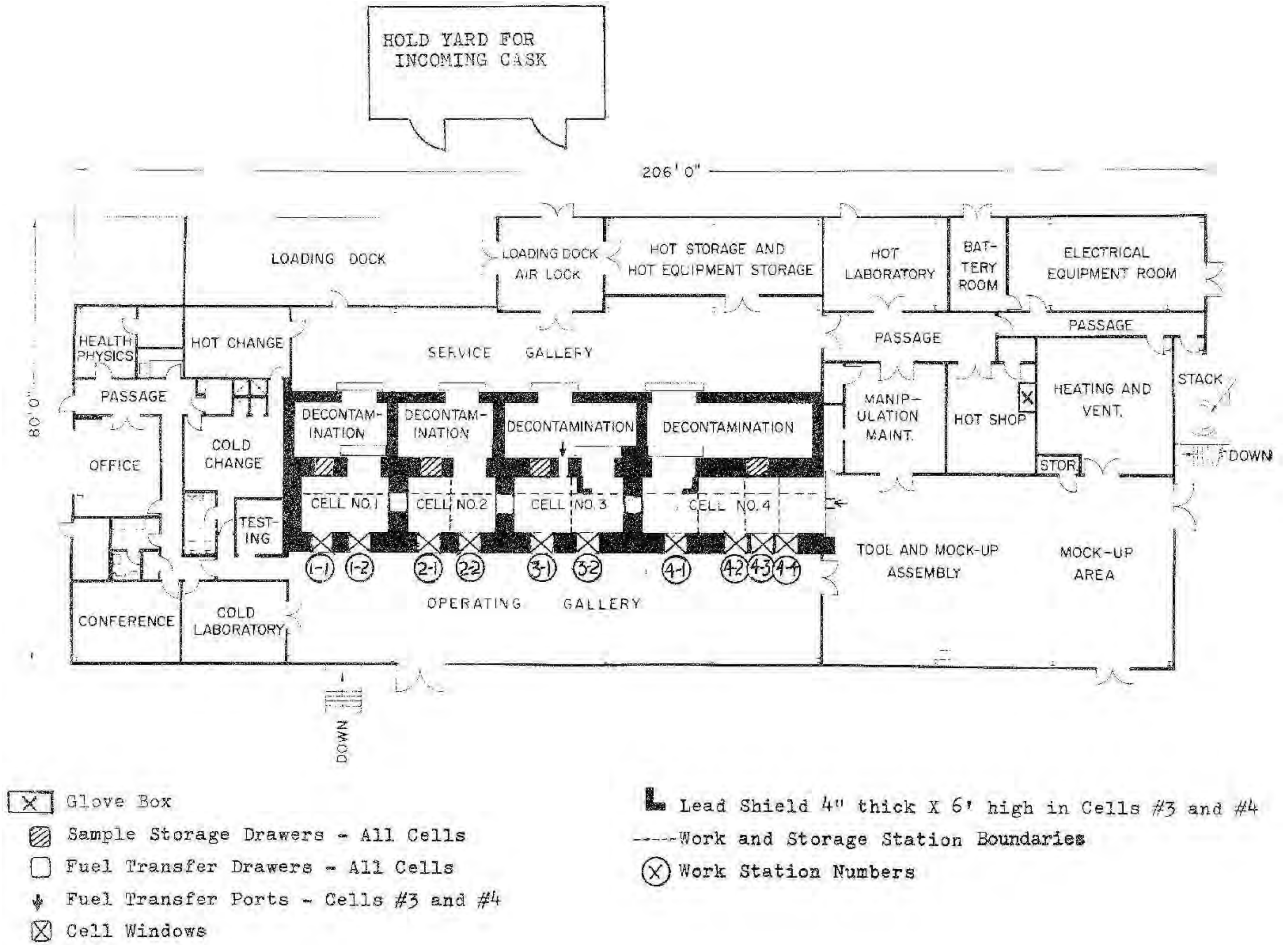
Figure 2.2.1e
Building 4020
Basement Sums
and Drainage



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Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

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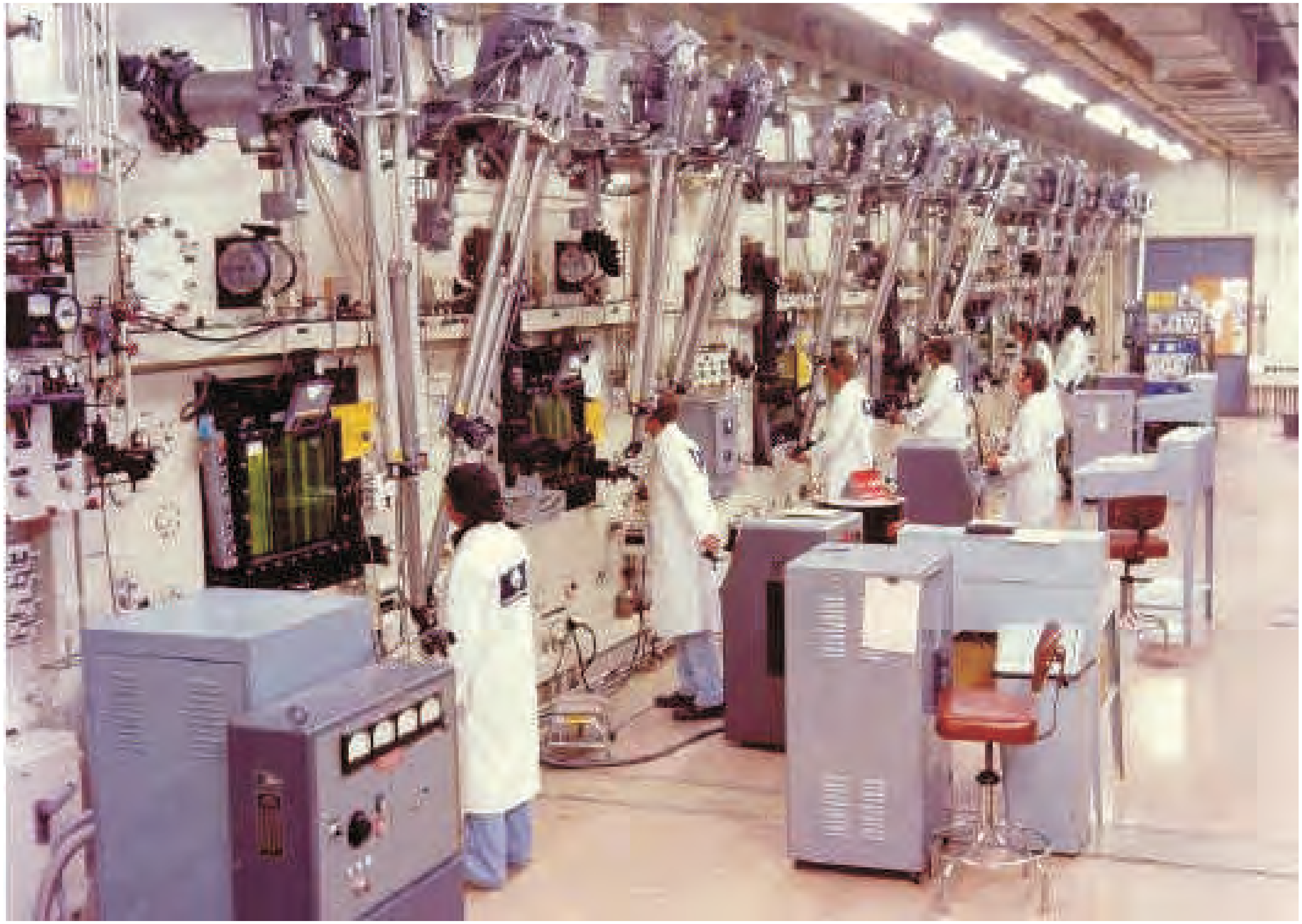
Figure 2.2.1f
Building 4020
Floor Plan

Redacted



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Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

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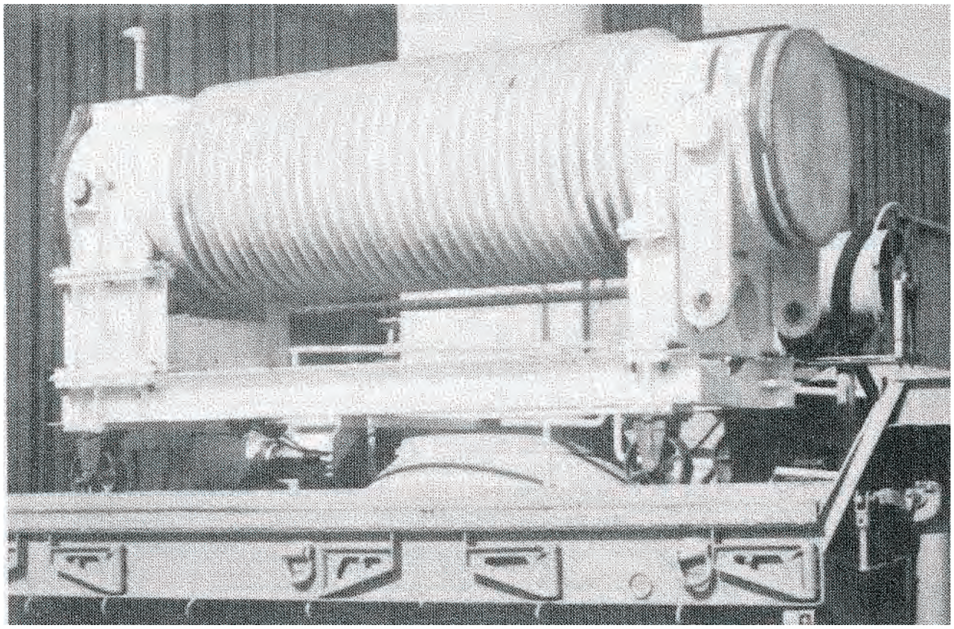
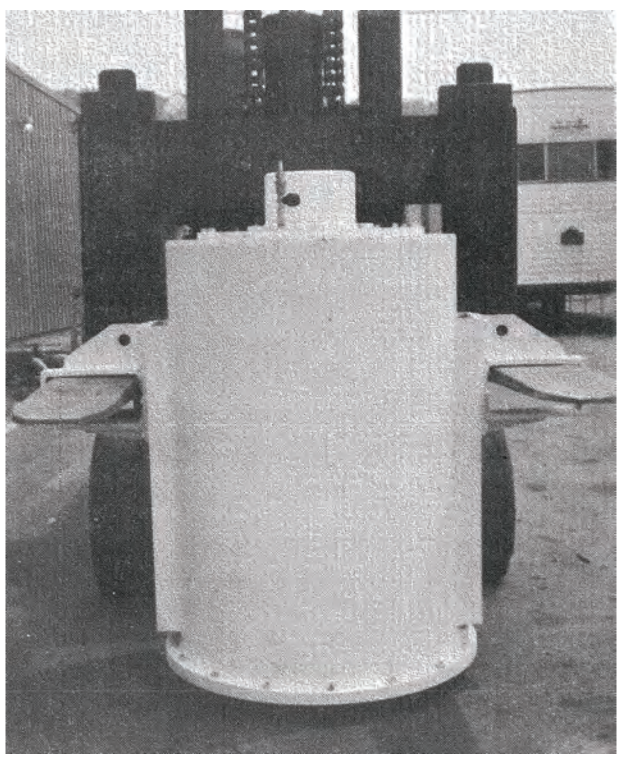
Figure2.2.1g
Building 4020
Operating Gallery
Photograph

Redacted





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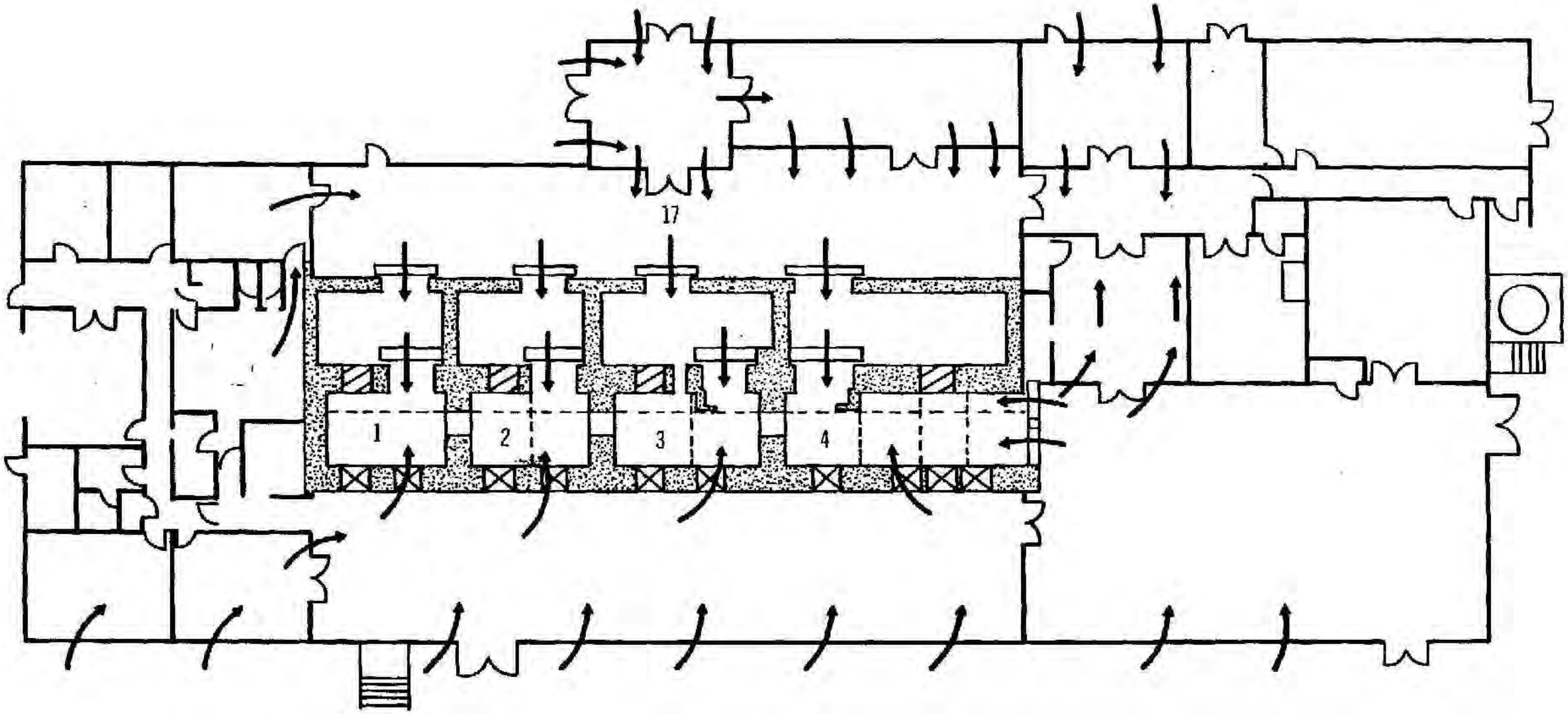
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1h
Building 4020
Piqua and
S8ER Casks



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Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1i
Building 4020
Ventilation Flow Diagram

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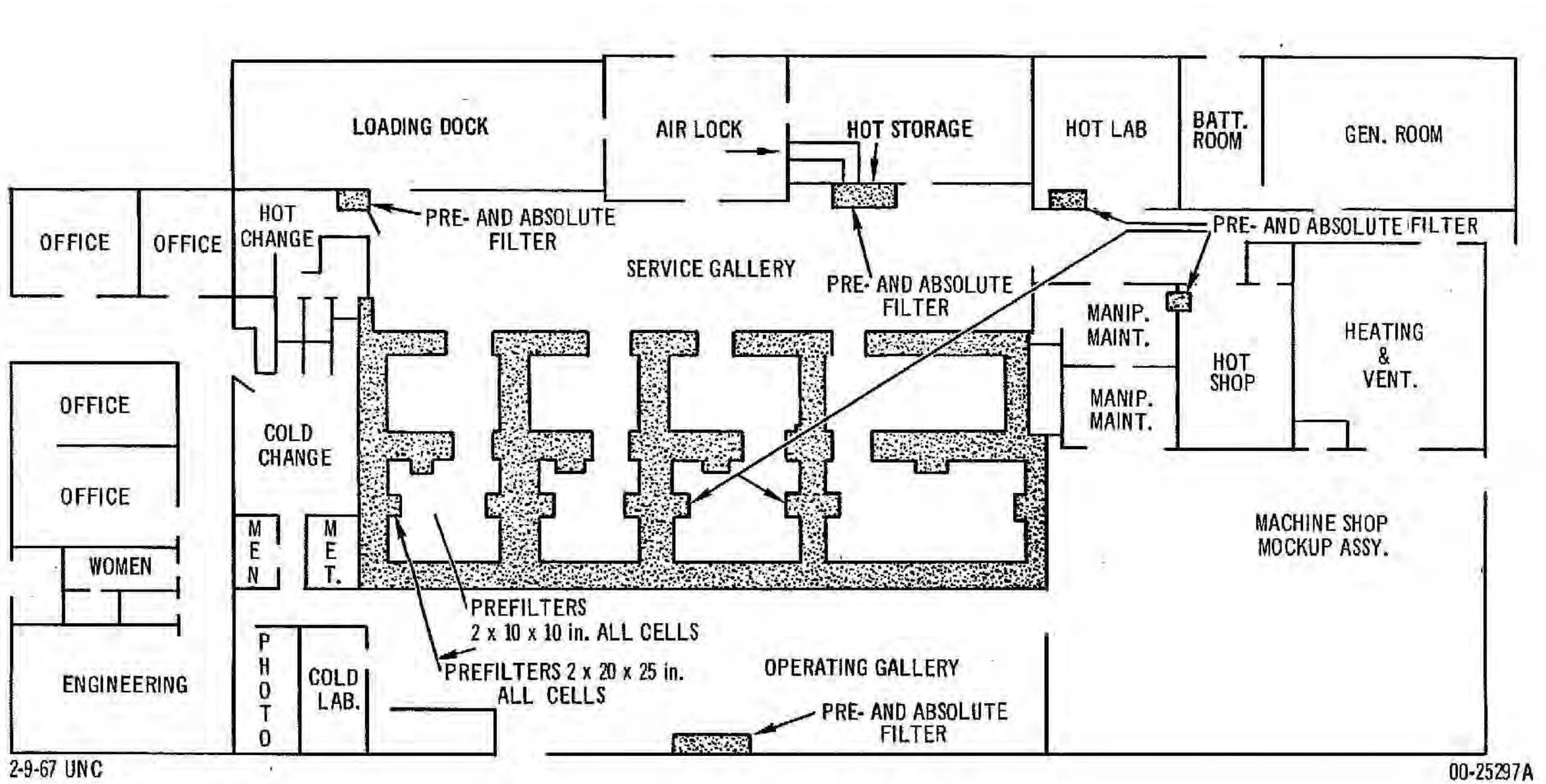

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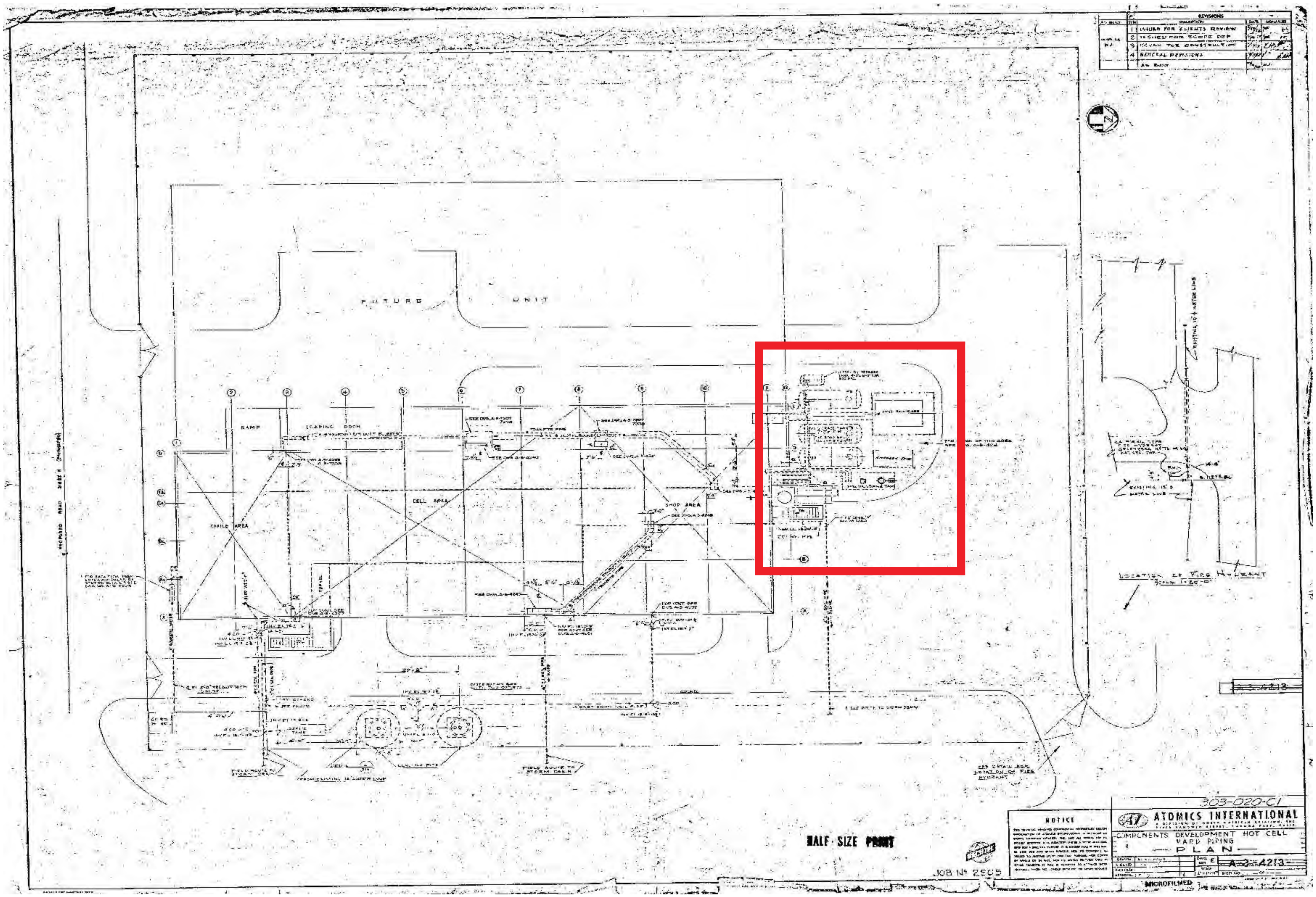
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1j
Building 4020
Vent Filter
Locations



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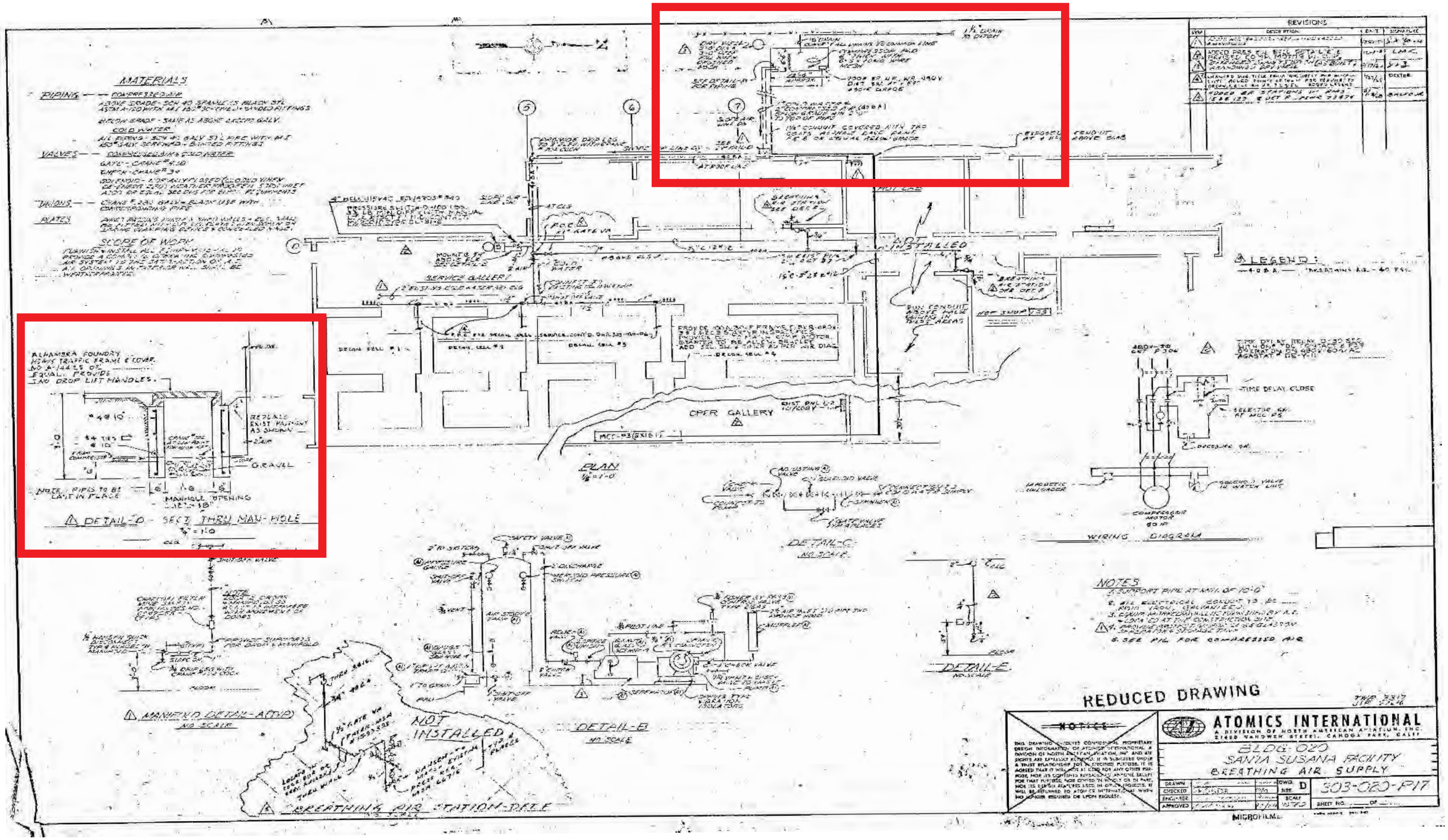
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1k
Building 4020
Underground Fission Gas Tank Locations

Redacted



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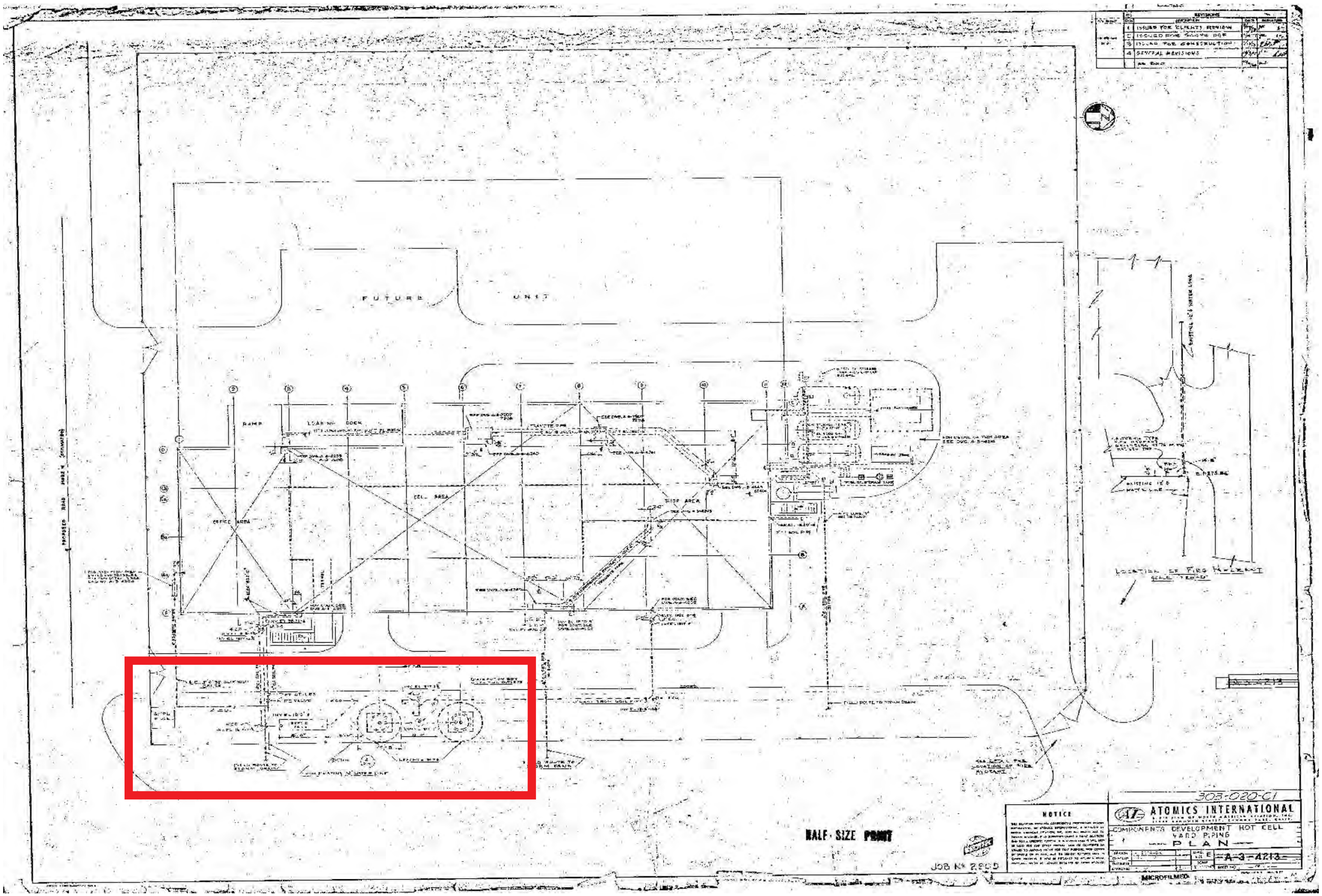
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.11
Building 4020
Leach Field and
Manhole Detail

Redacted



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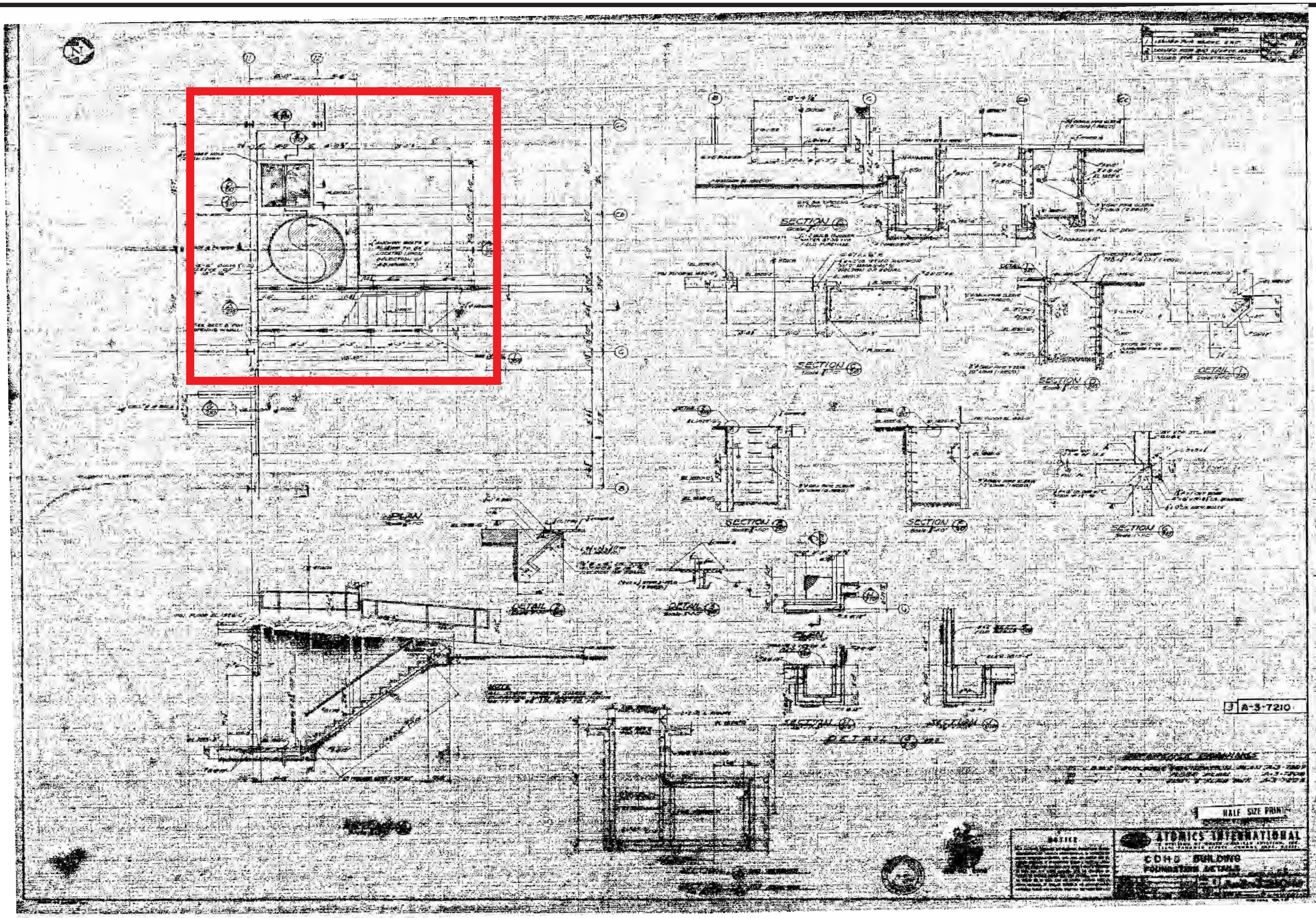
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1m
Building 4020
Leach Field and
Leaching Pits Piping

Redacted



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Project:EP9038
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1n
Building 4020
Stack and
Manhole Detail

Redacted

Area	Removable (dpm/100 cm ^{2})		Fixed (mrad/hr)	
	General Surfaces	Inaccessible Surfaces	General Surfaces	Inaccessible Surfaces
Hot cells 1,2,3,4	>1,000,000	>1,000,000	400	5000
Decon rooms 1,2,3,4	50,000	500,000	10	30
Hot slave shop	200,000		10	
Service gallery	500	2000	5	15
Hot laboratory, material testing laboratory, air lock, and change rooms	200	100,000* (glove box)	15	2
Operating gallery	200 (Cell face)	20,000	30 (Cell face)	5
Boiler room, battery room, generator room cold slave shop, and equipment room	<50	--	2	--
Metallograph room, chemical laboratory, and offices	<50	--	--	--
Tool and mock-up area	<50	200	5	--
Basement	5000	>1,000,000 (R/A exhaust)	10	5000
Attic	1000	--	--	--
West loading dock and pad, north loading dock and pad, and hot storage yard	100	--	10	--
Radioactive liquid tank and building	500	5000	50	0.2

*Alpha contamination contained inside glove box

D638-0020

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Project:EP9038
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1o
Building 4020
Projected Radioactive Contamination

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Project:EP9038
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1p
Building 4020
Stockpiled Soil
During Basement
Demolition

Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-2-1q)Bldg4020CE.cdr
Project:EP9038
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1q
Building 4020
Completed Building
Excavation

Backfilling and Compaction of the Basement Excavation. [ETEC-10/24/97-395401]

Site After Backfilling the Basement Excavation. [ETEC-11/4/97-395422]

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Source: Boeing Company, 2008

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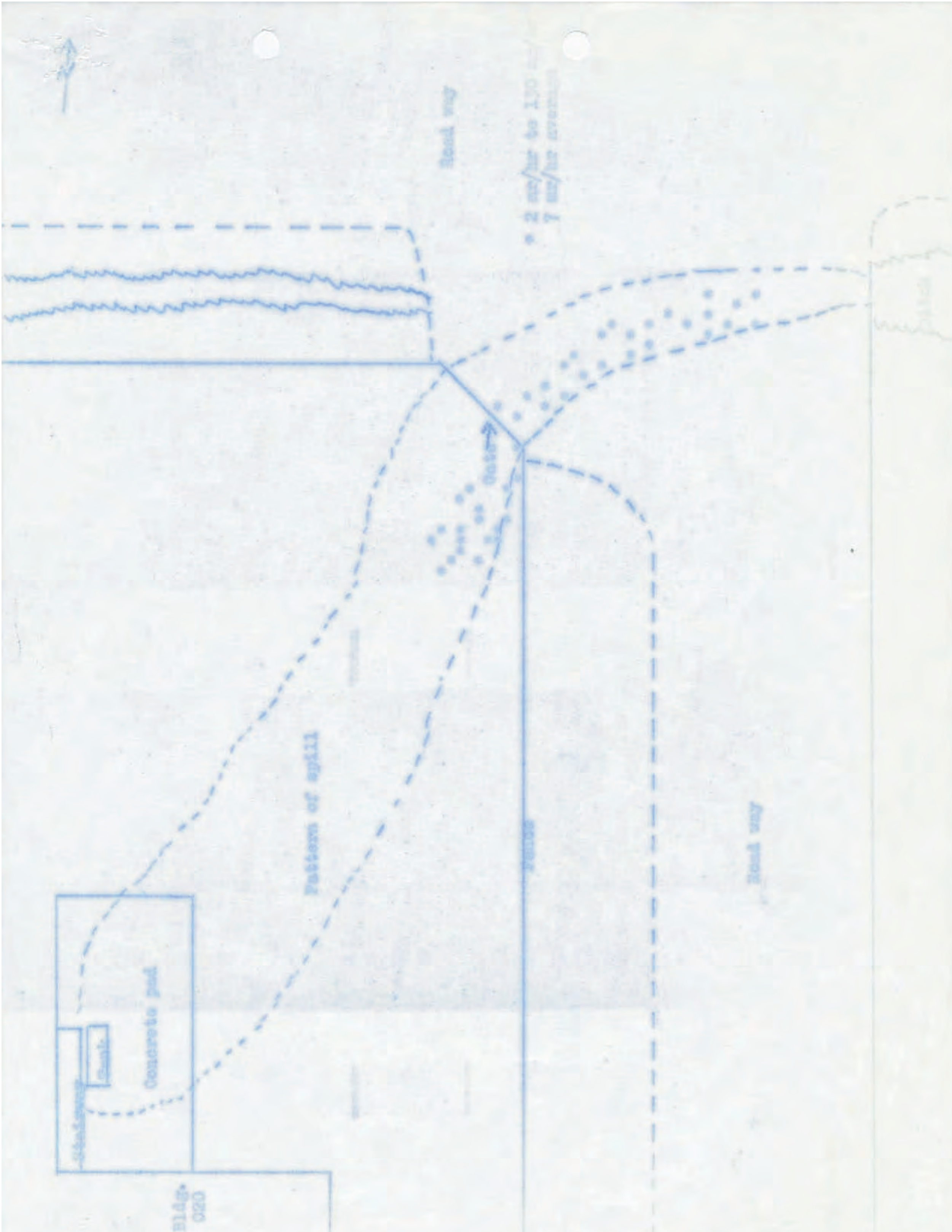
Figure 2.2.1r
Building 4020
Backfilling Operations
and Completion



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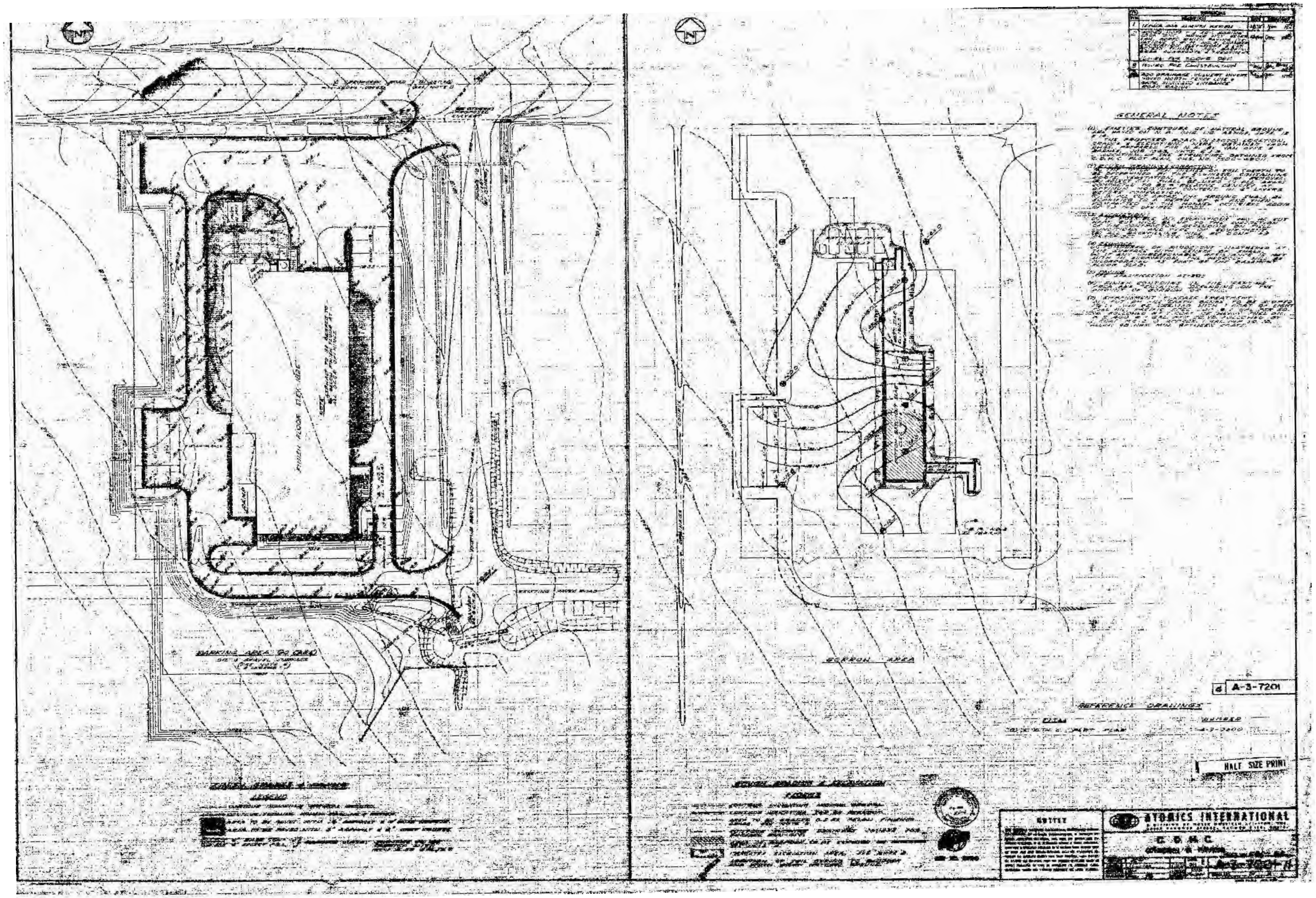
U.S. EPA Region 9

Figure 2.2.1s
Building 4020
A0016 Incident
Report Spill



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Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.1t
Building 4020
Grading and
Paving

Redacted

*Y:/Santa_Susana/EP9038/TM/HSA_5D
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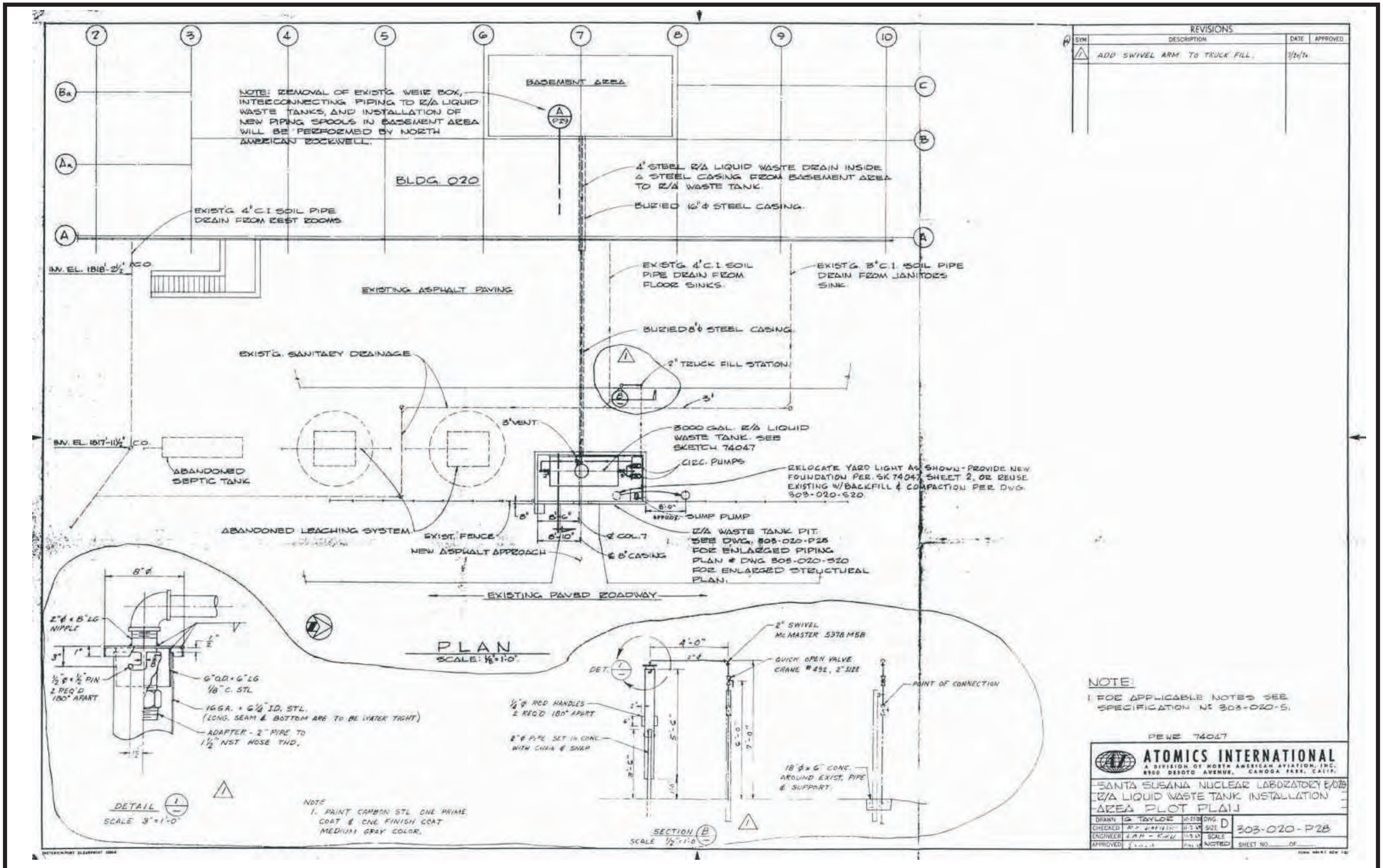
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008*

U.S. EPA Region 9

**Figure 2.2.2a
Building 4468
Site Photograph**

Redacted



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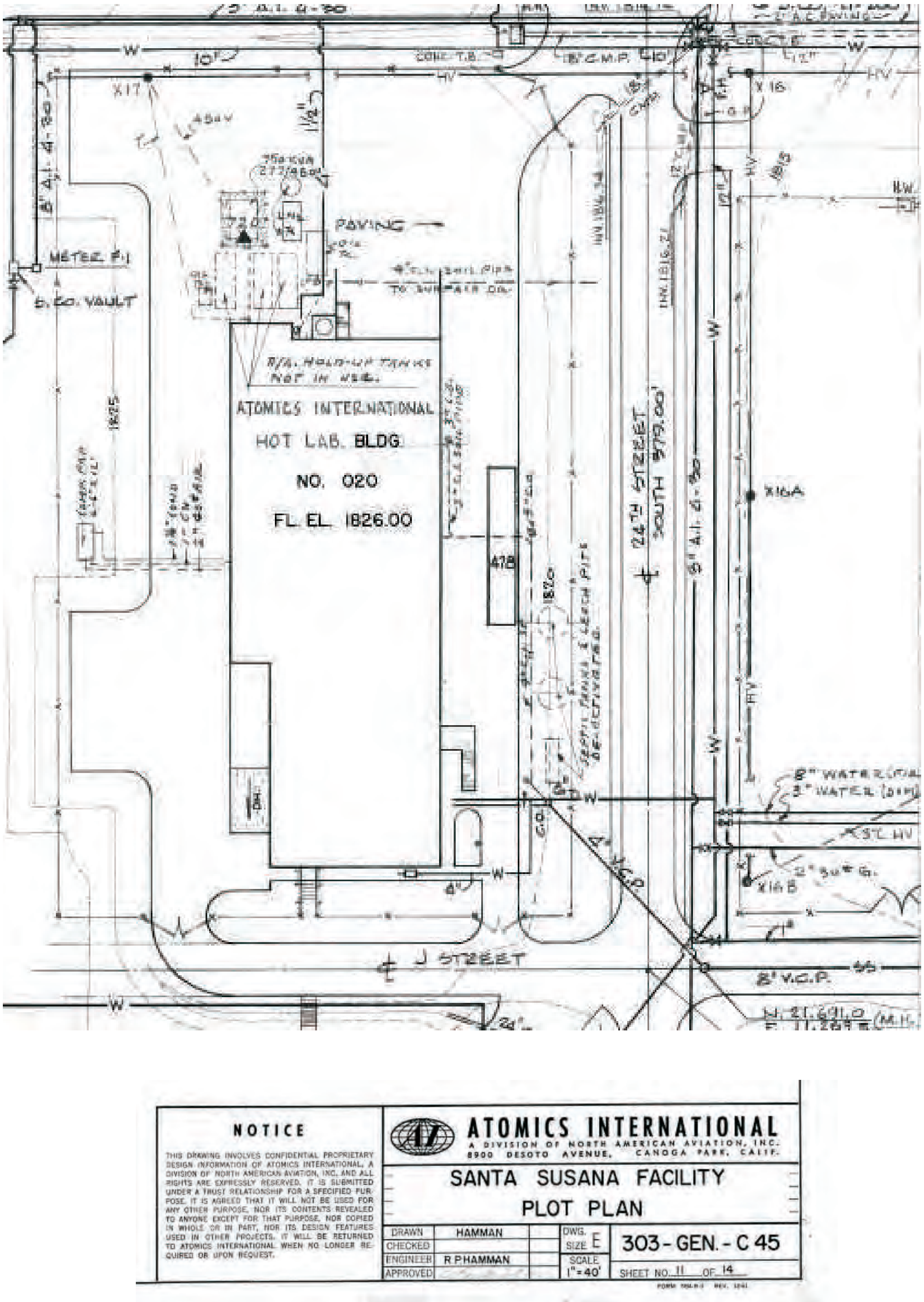
Project:EP9038
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.2b
Building 4468/4020
Piping Plan

Redacted



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Project:EP9038
Revised: 03/21/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.2c
Building 4468
Plot Plan

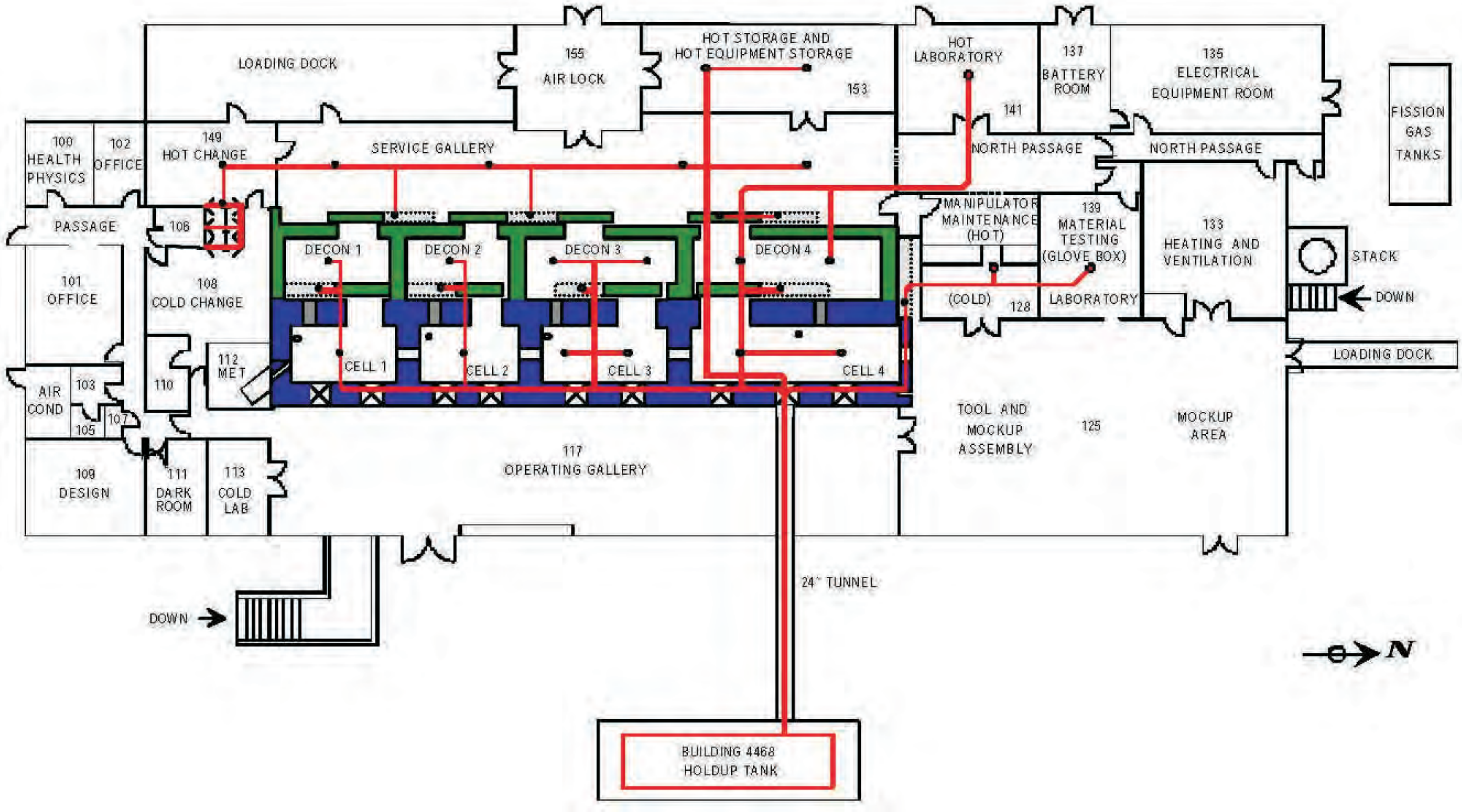
Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-2-2d)DemolitionDP.cdr
Project:EP9038
Revised: 03/21/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.2d
Building 4468
Demolition Photograph

Redacted



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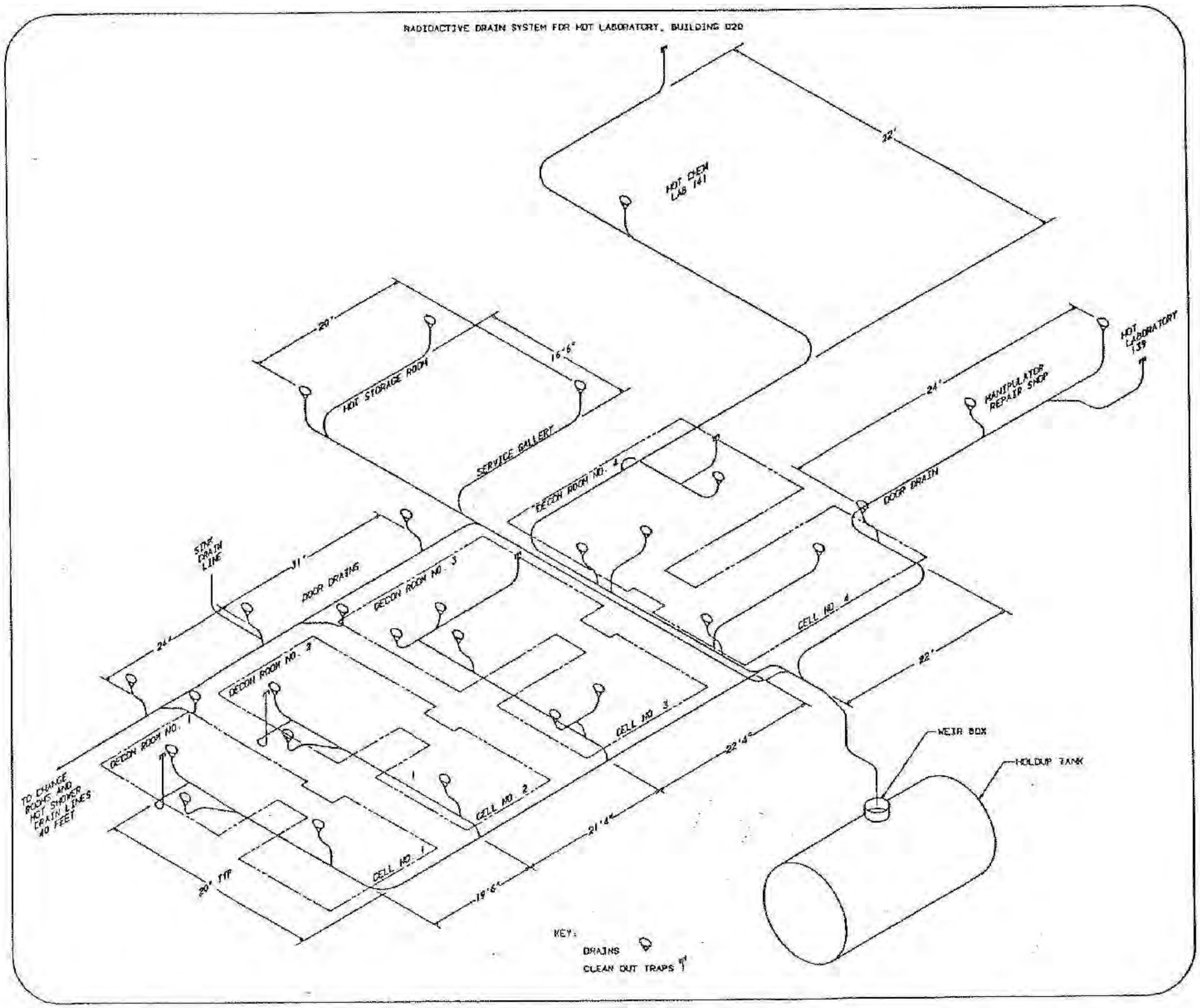
Project:EP9038
Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.2.2e
Building 4468/4020
Drain Lines



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Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

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Figure 2.2.2f
Building 4468
Radioactive
Drain System

Redacted

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Revised: 03/24/2011 TJ
Source: Boeing Company, 2008

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Figure 2.2.2g
Building 4468
Liquid Waste
Facility Building
1997

Redacted

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Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

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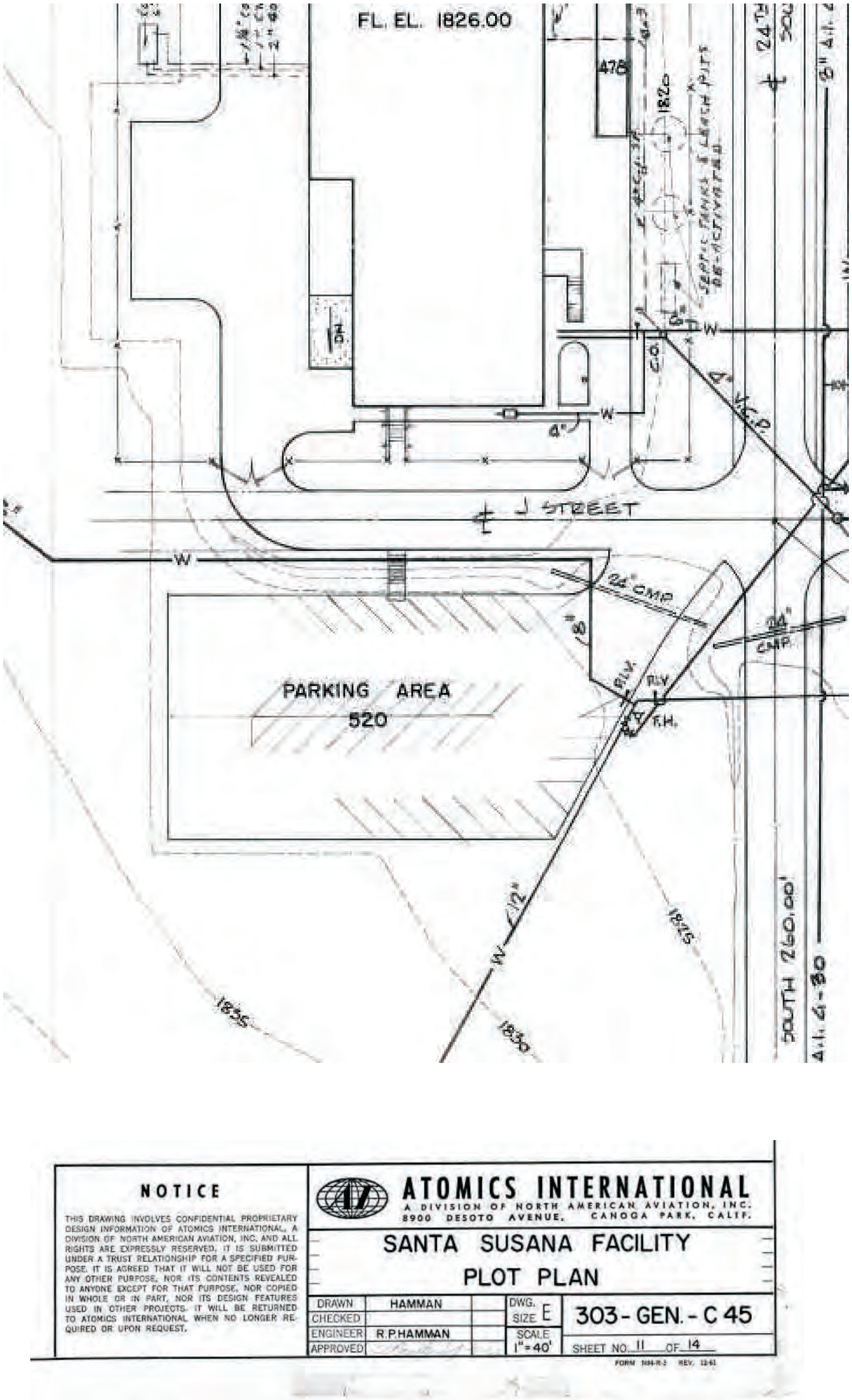
Figure 2.2.3a
Parking Lot 4520
Site Photograph



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Revised: 03/21/2011 TJ
Source: Boeing Company, 2008

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Figure 2.2.3b
Building 4520
Plot Plan

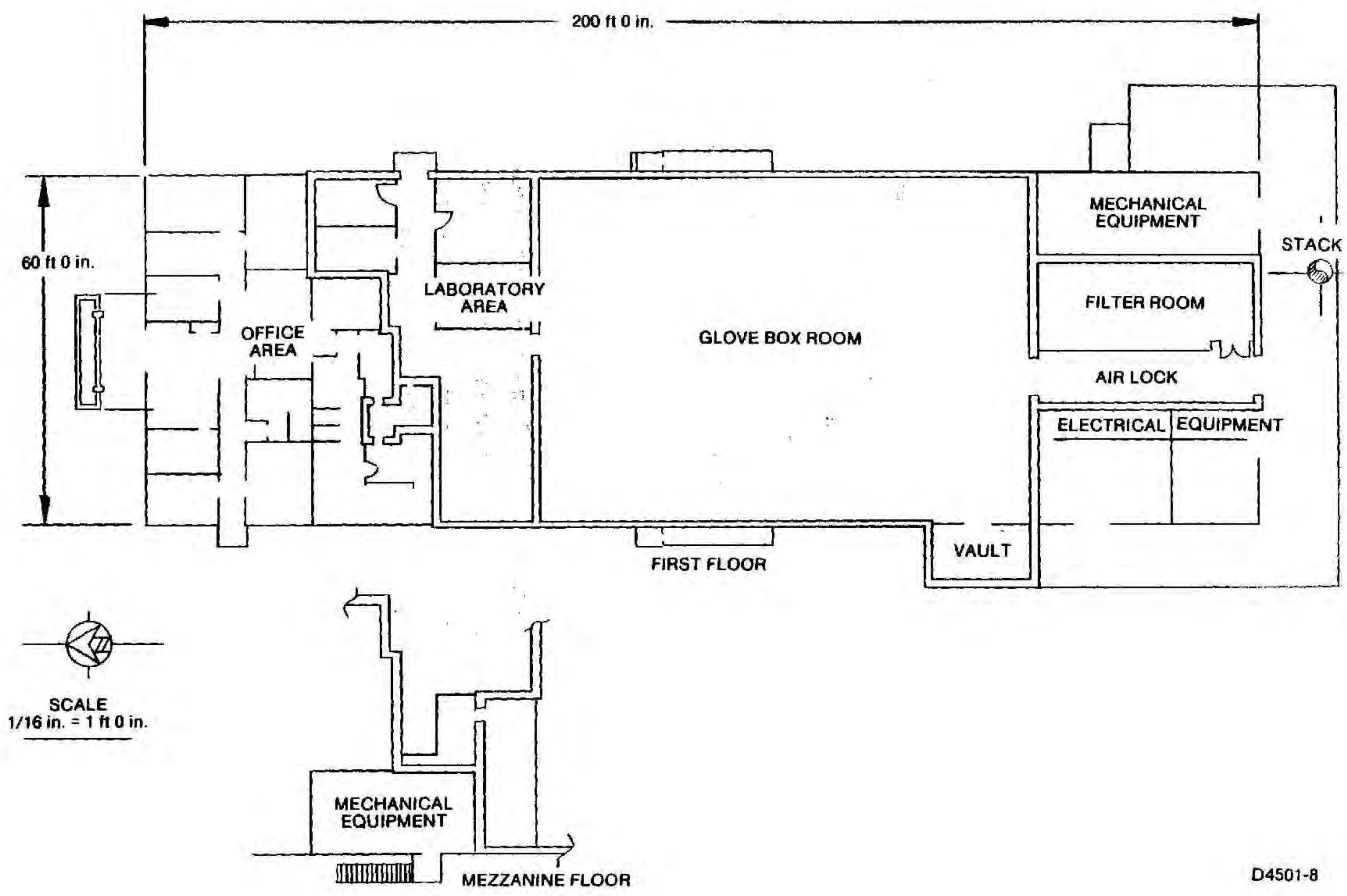
Building 4055 Looking North

Building 4055 Former Liquid Waste Tank Location

*Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-2-4a)Bldg4055SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008*

U.S. EPA Region 9

**Figure 2.2.4a
Building 4055
Site Photograph**



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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

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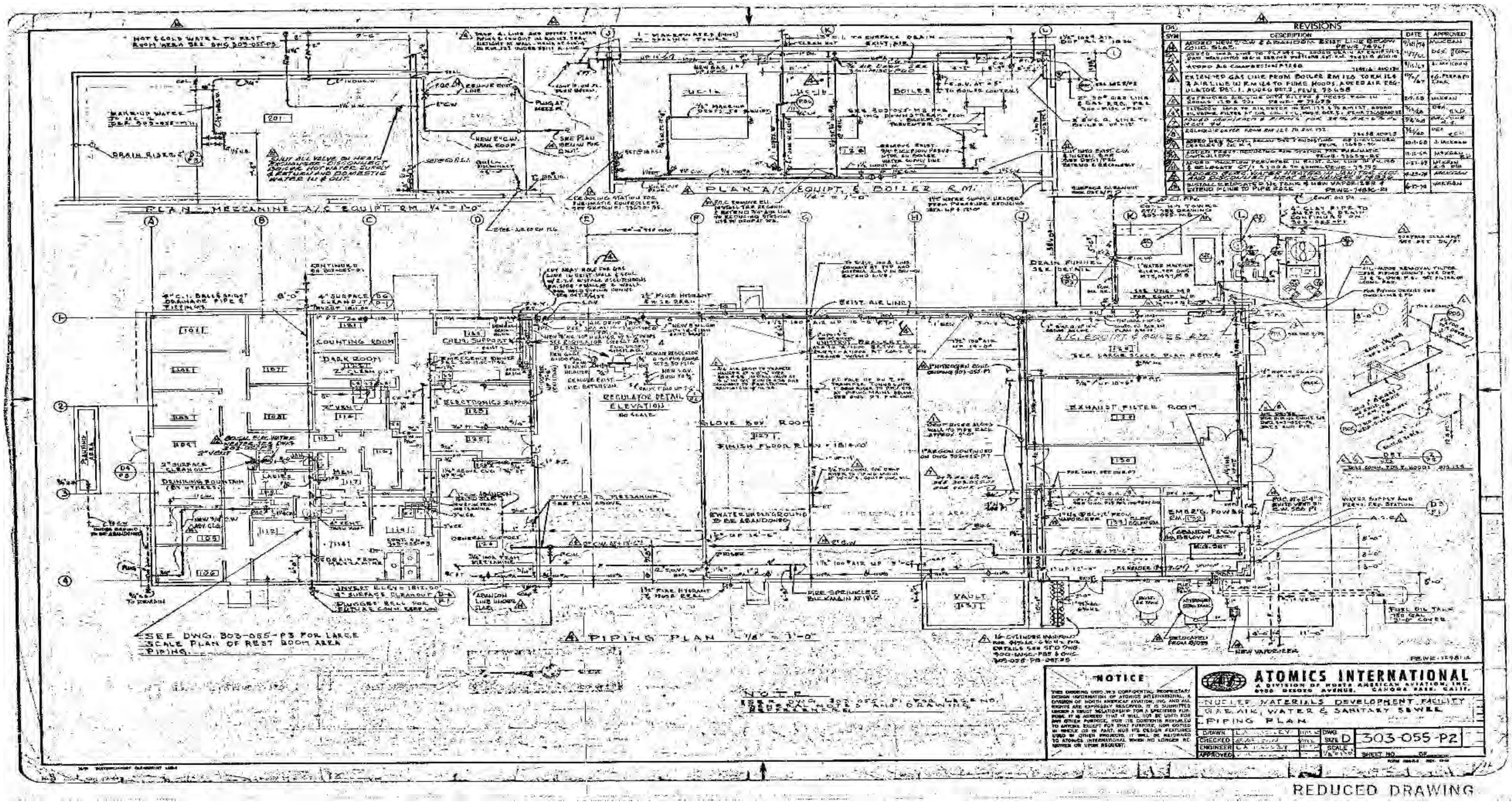
Figure 2.2.4b
Building 4055
Floor Plan

Redacted



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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

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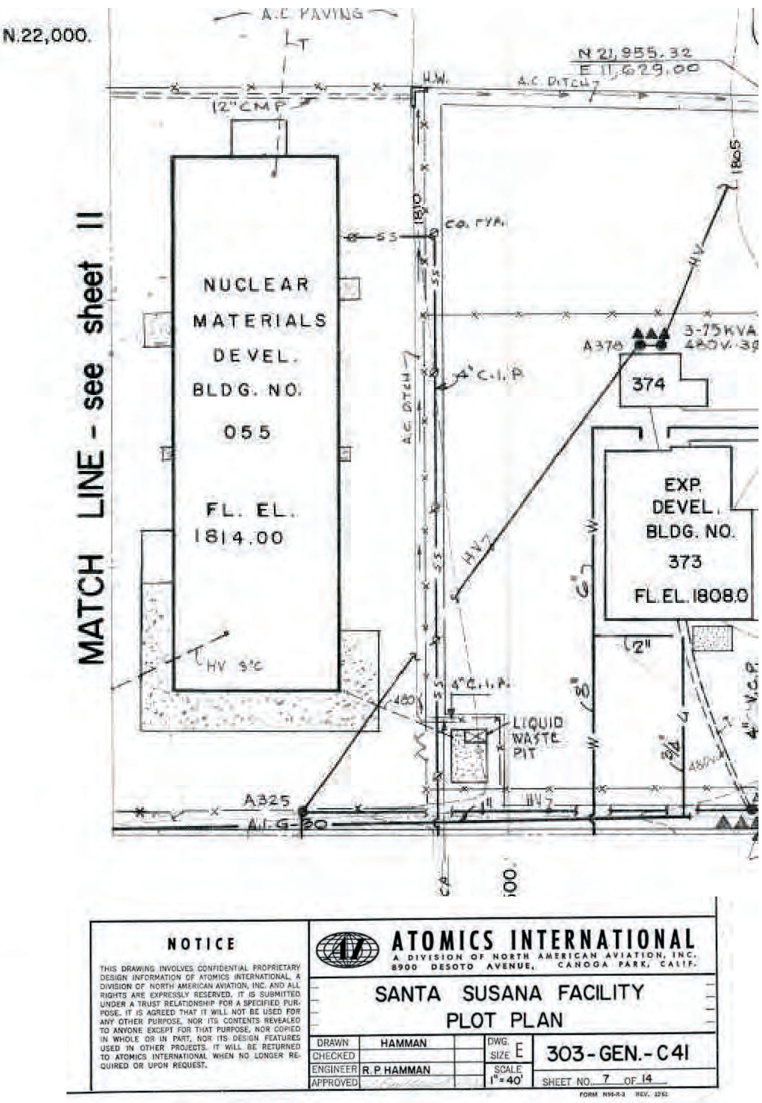
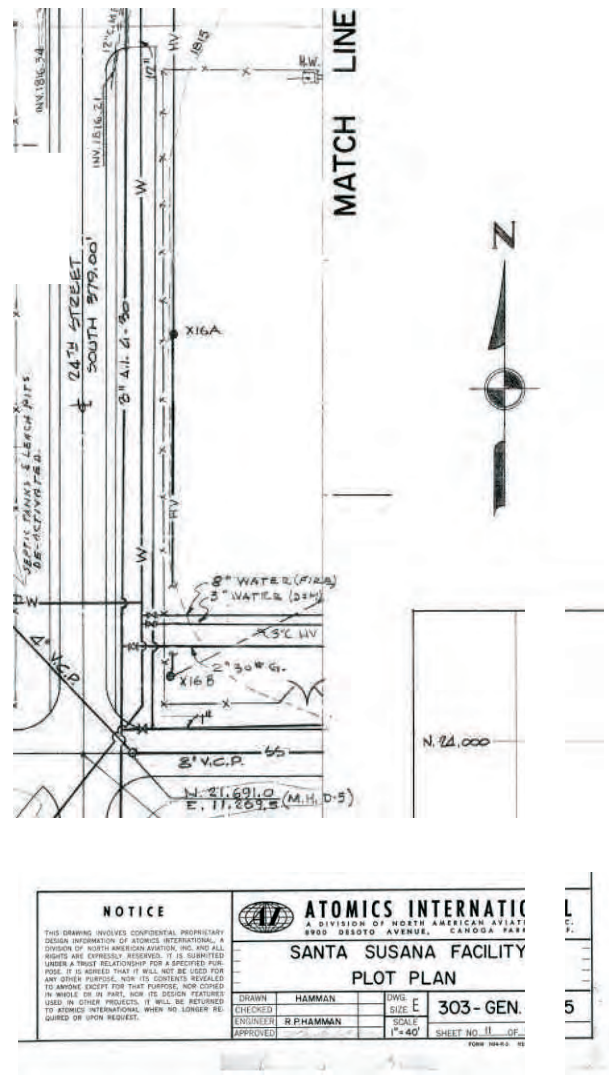
Figure 2.2.4c
Building 4055 Layout, Gas, Water and Sanitary Sewer Piping Plan

Redacted





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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

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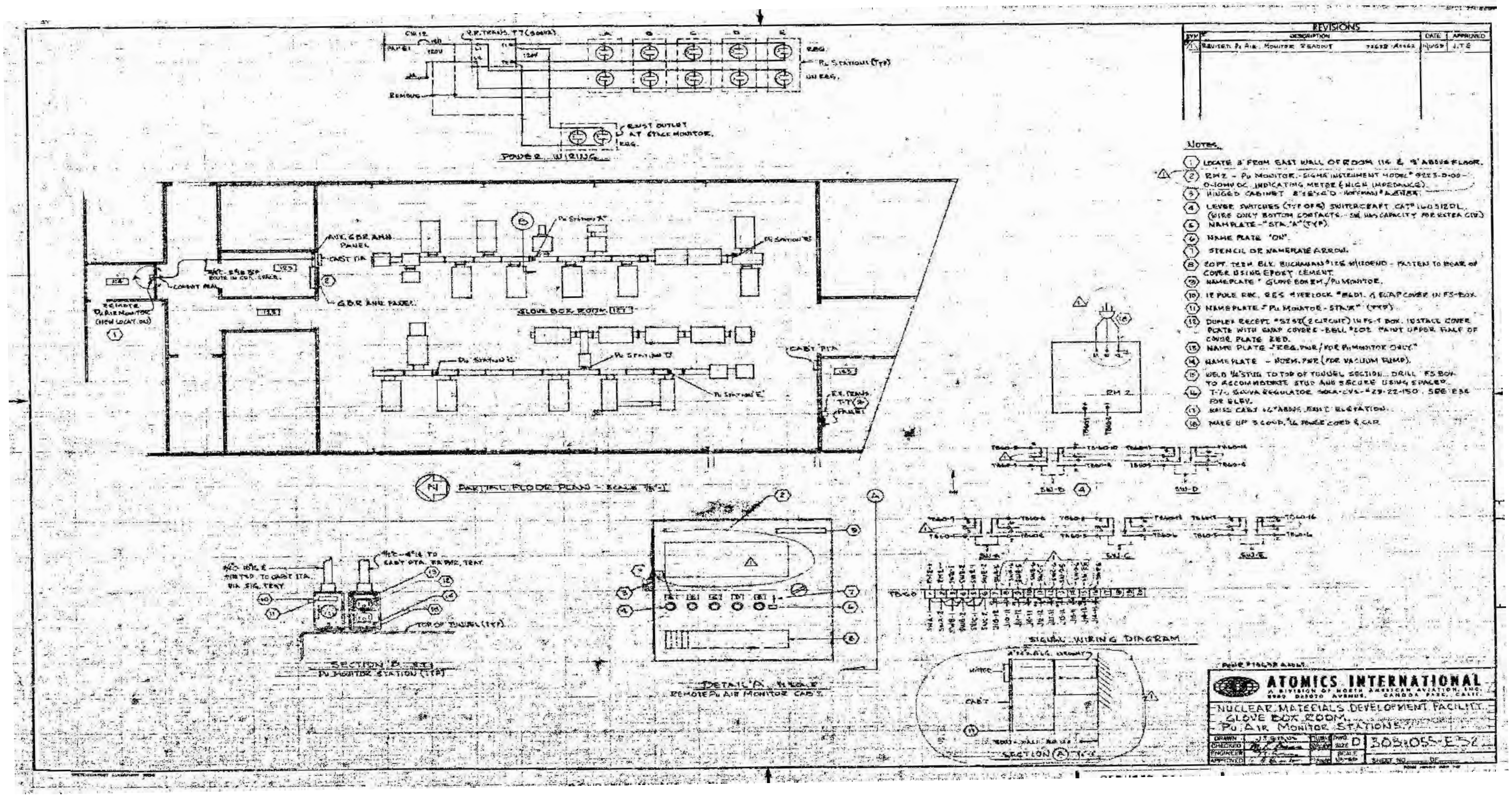
Figure 2.2.4d
Building 4055
Plot Plan



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Source: Boeing Company, 2008

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Figure 2.2.4e
Building 4055
Glove Box
Room Layout

Redacted

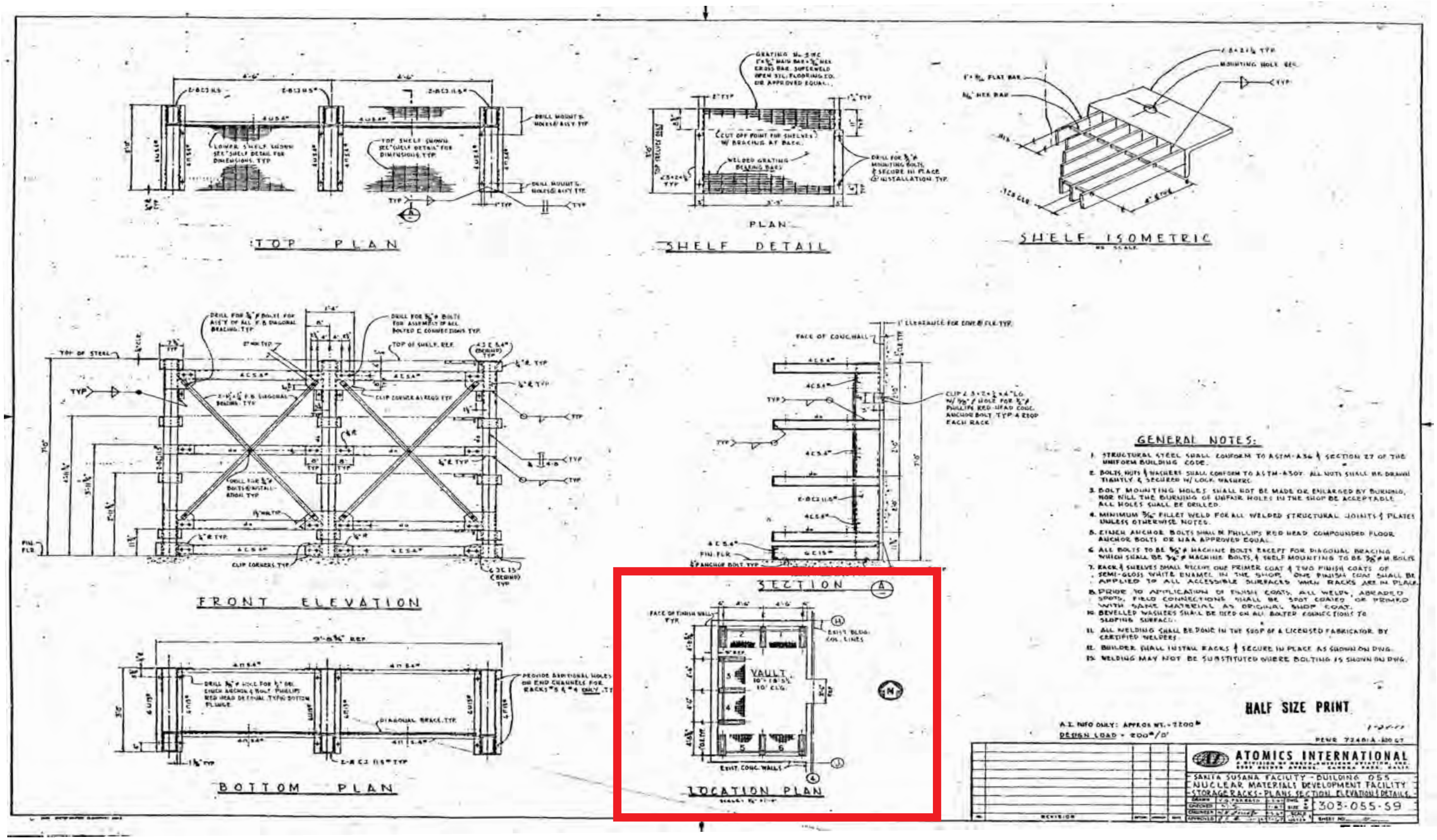

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Figure 2.2.4f
Building 4055
Storage Vault

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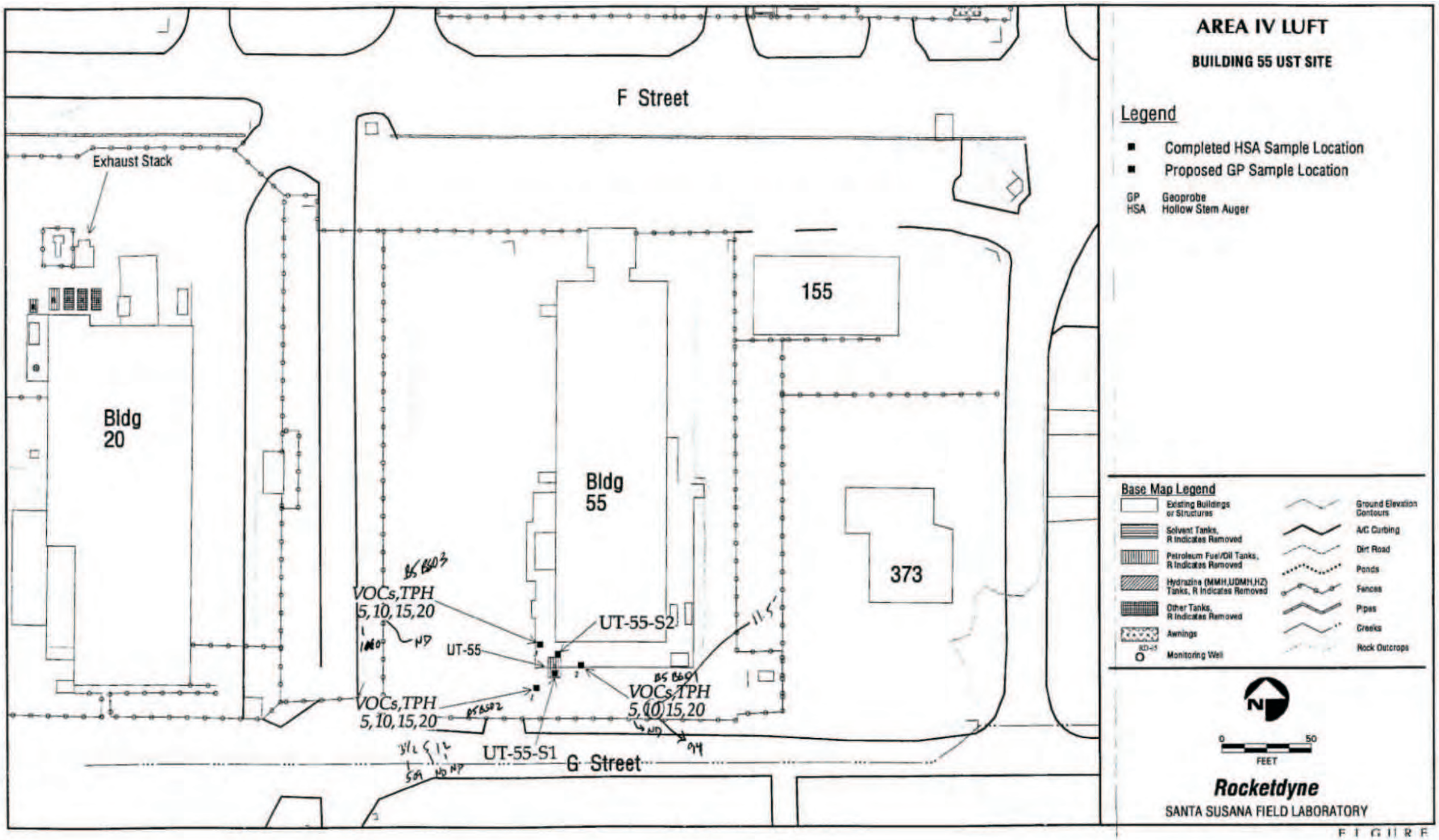

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Source: Boeing Company, 2008

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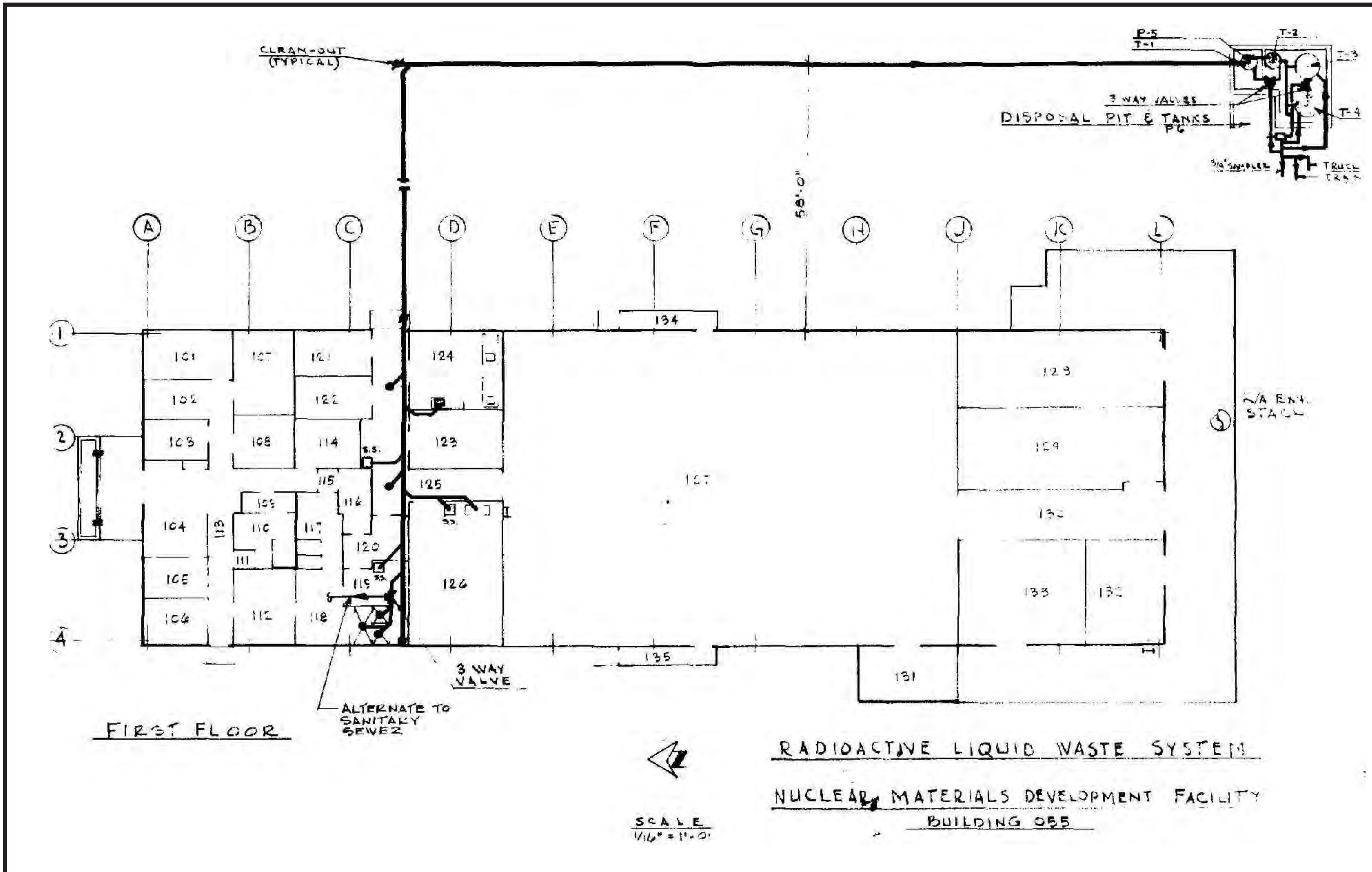
Figure 2.2.4g
Building 4055
UT-55 Diesel Storage Tank Location



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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

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**Figure 2.2.4h
Building 4055
Liquid Waste
Holdup System**

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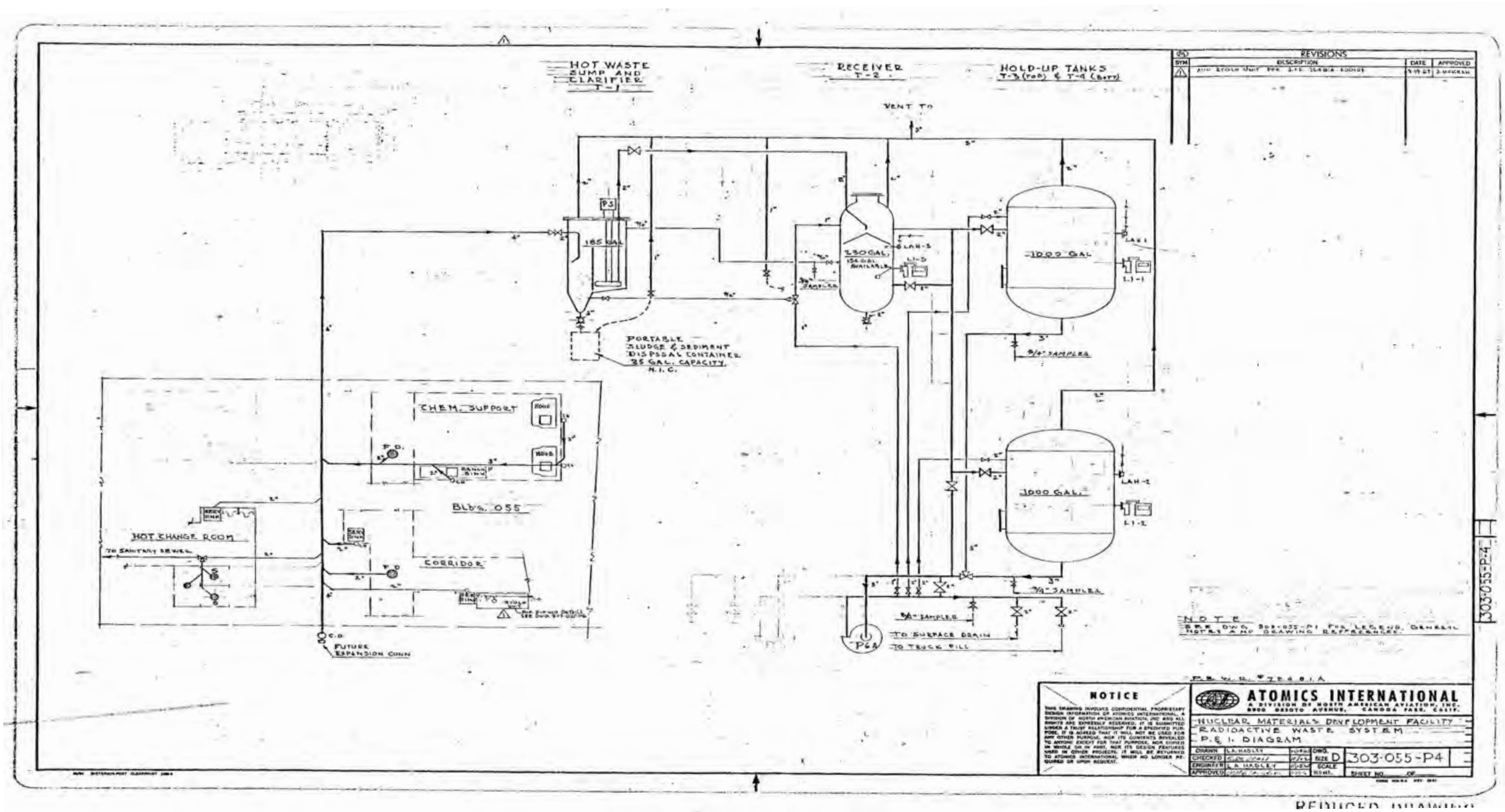

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Source: Boeing Company, 2008

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Figure 2.2.4i
Building 4055
Radioactive Waste
System P&I Diagram

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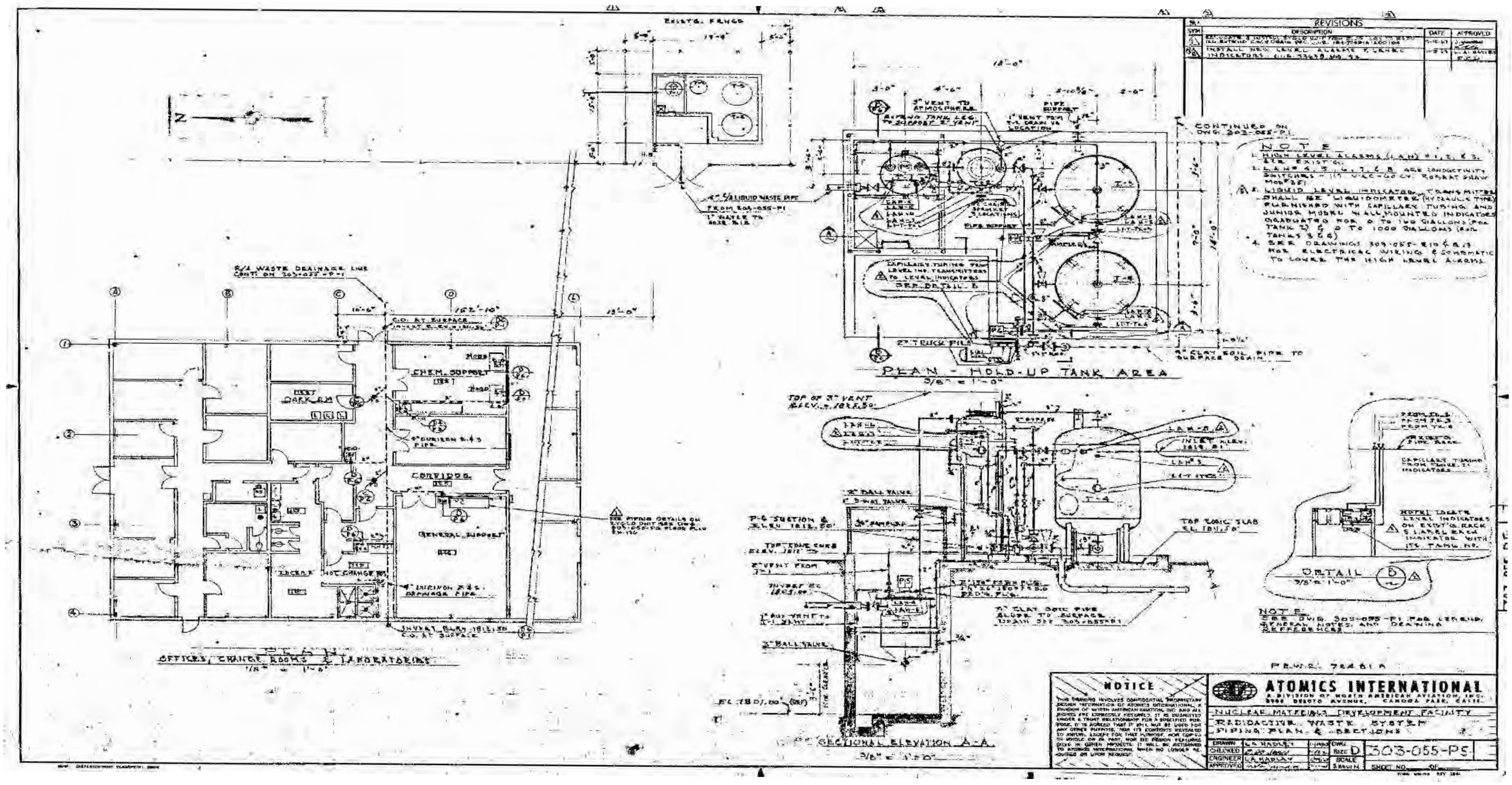

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Figure 2.2.4j
Building 4055
Radioactive Waste System Piping Plan and Sections

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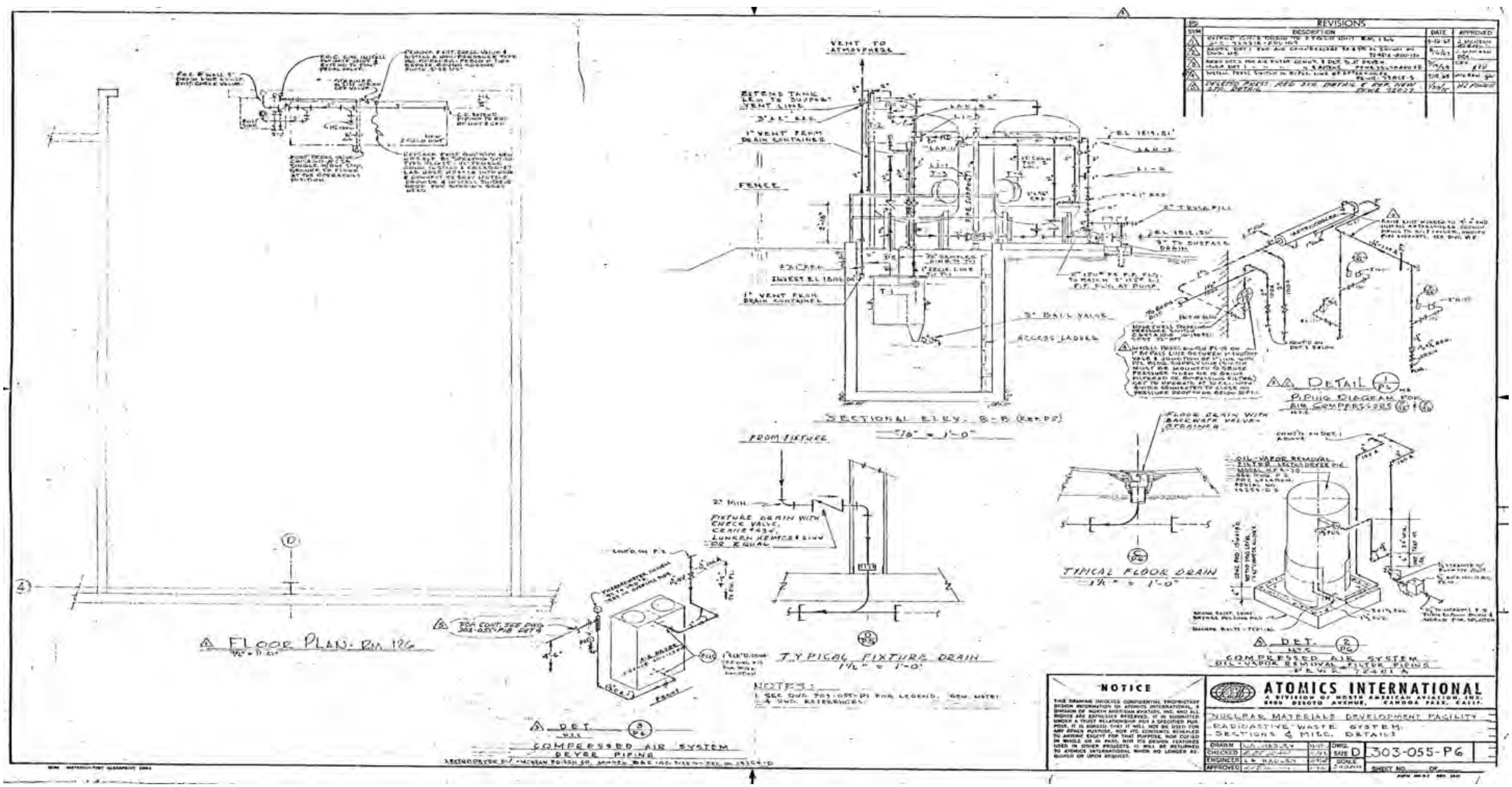

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Source: Boeing Company, 2008

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Figure 2.2.4k
Building 4055
Radioactive Waste System Sections & Miscellaneous Detail

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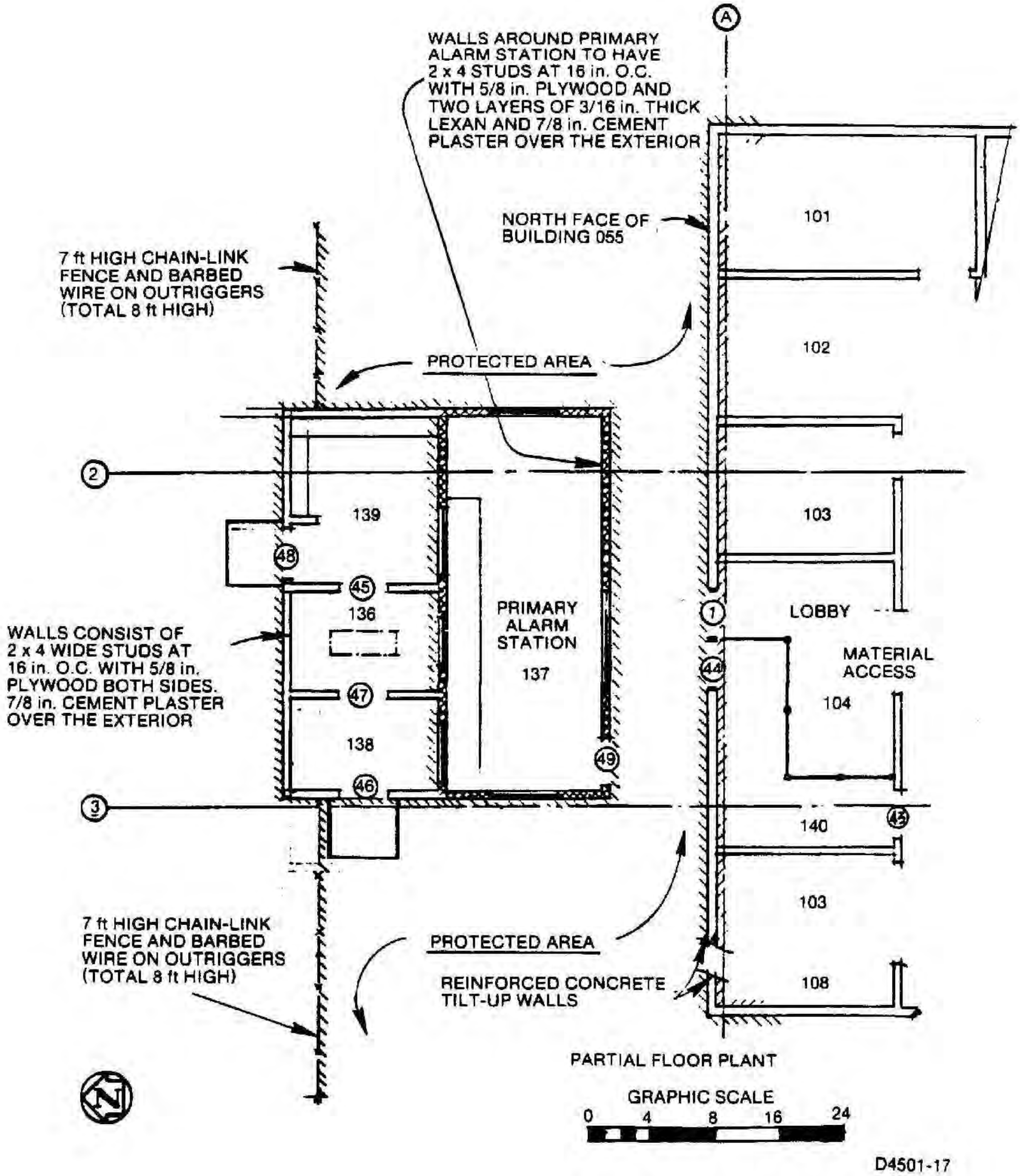

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Source: Boeing Company, 2008

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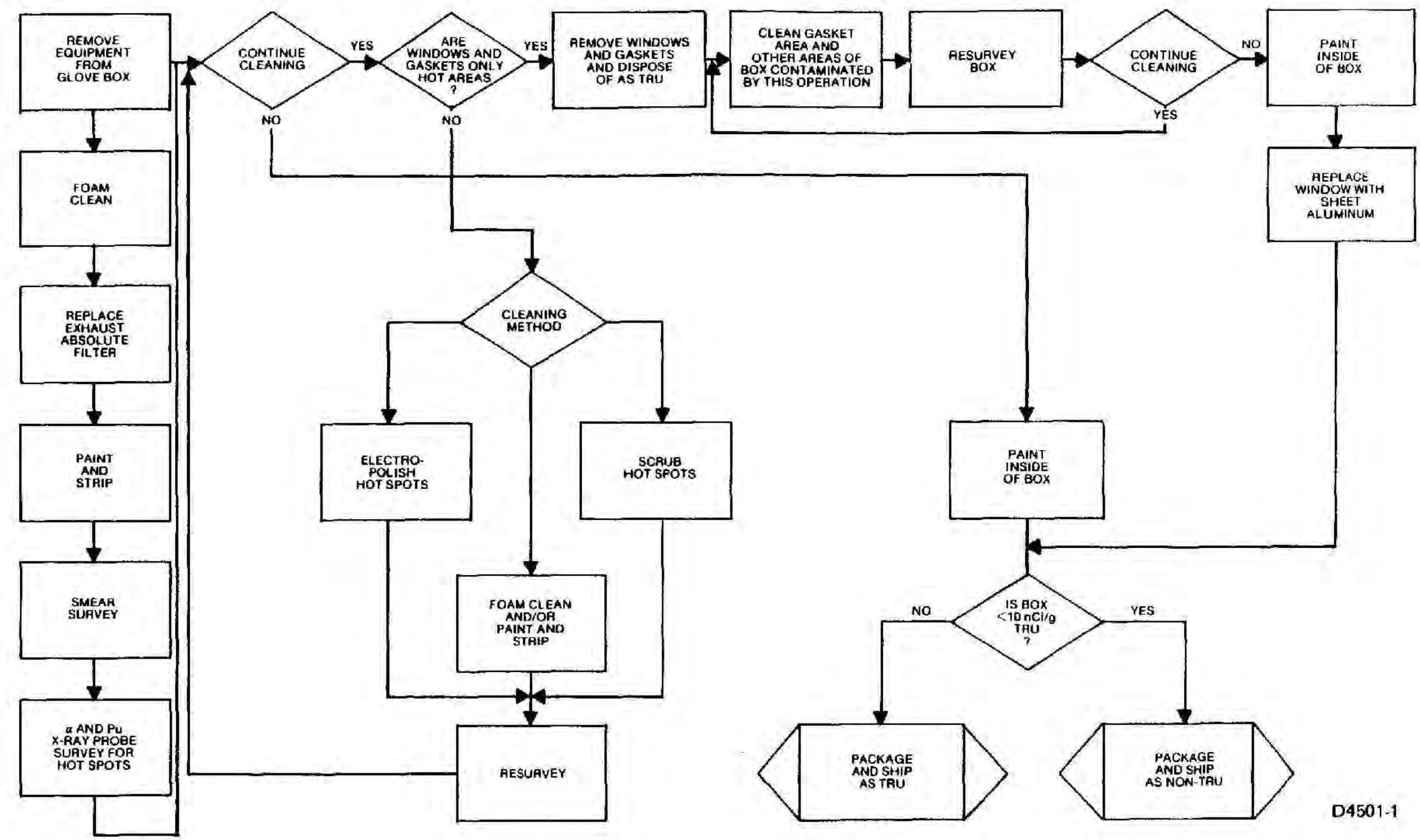
Figure 2.2.4l
Building 4055 Security Post Layout



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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

**Figure 2.2.4m
Building 4055
Glove Box Cleaning
Flow Diagram**

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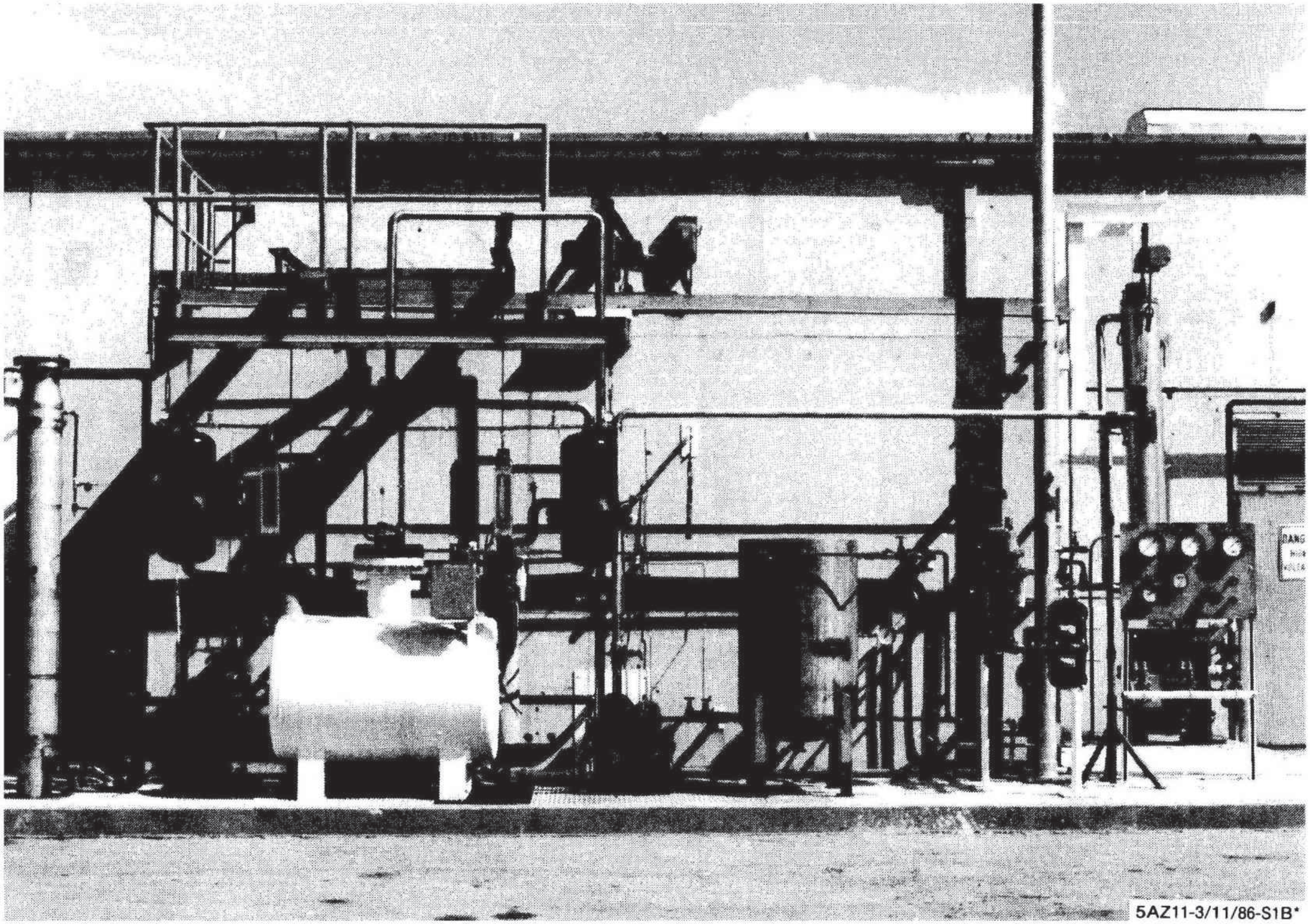

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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

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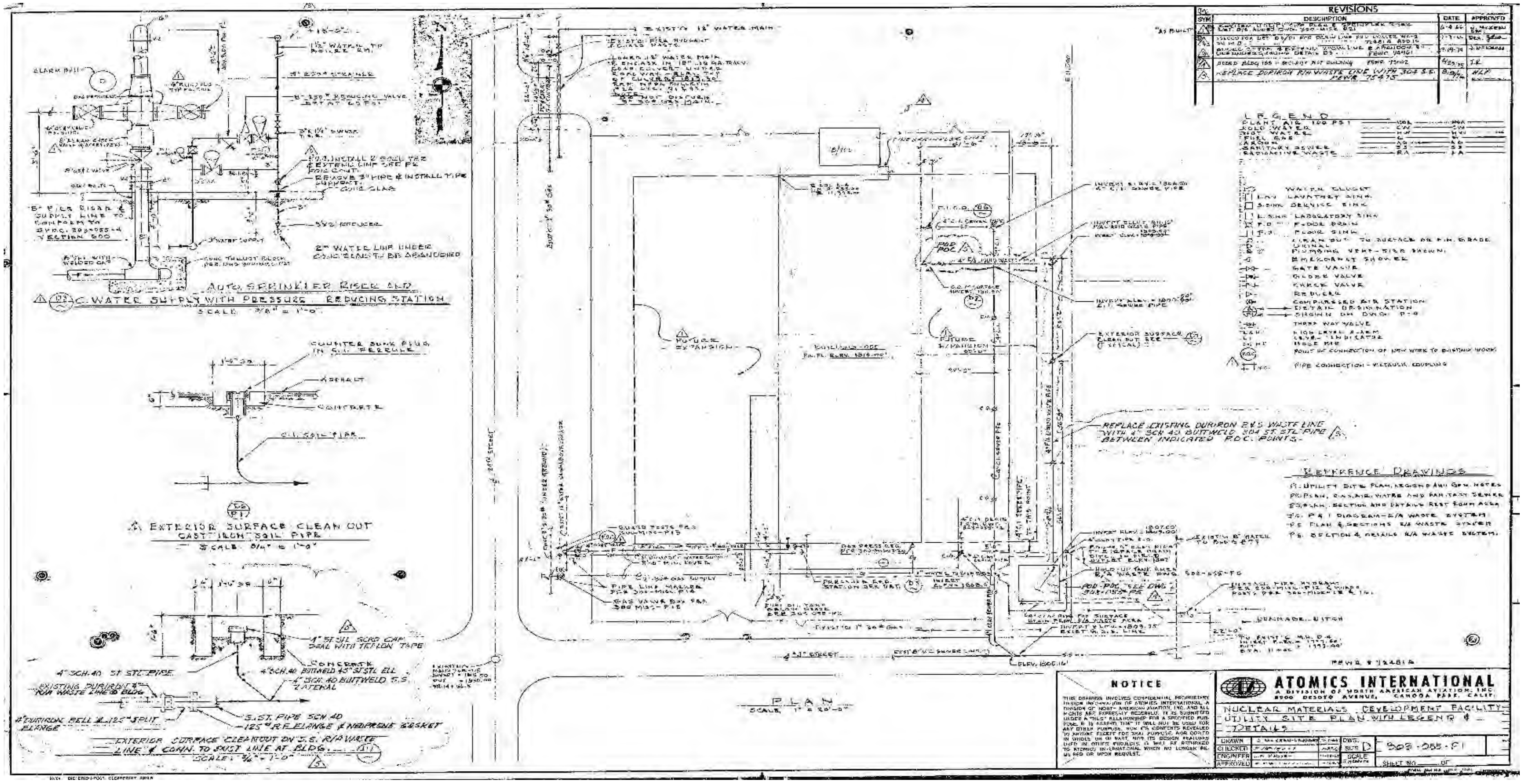
Figure 2.2.4n
Building 4055
NaK bubbler
Cleaning Facility
Photograph



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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

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Figure 2.2.4o
Building 4055
Radioactive Waste
System Utility
Site Plan

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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

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Figure 2.2.4p
Building 4055
Glove Box B8
Radwaste Combustion Installation

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Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

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Figure 2.2.5a
Building 4373
Site Photograph

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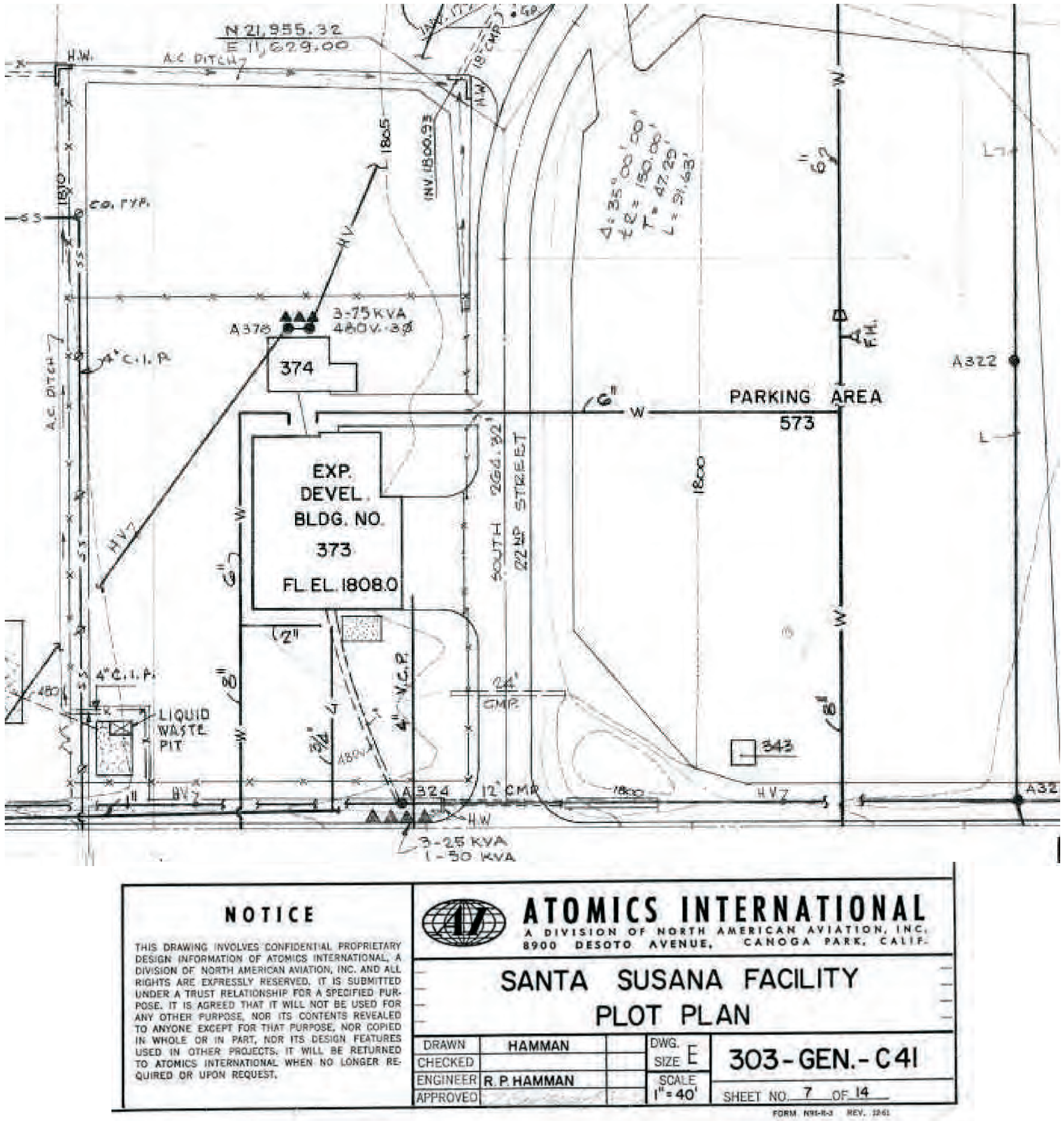

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Source: Boeing Company, 2008

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Figure 2.2.5b
Building 4373
Plot Plan

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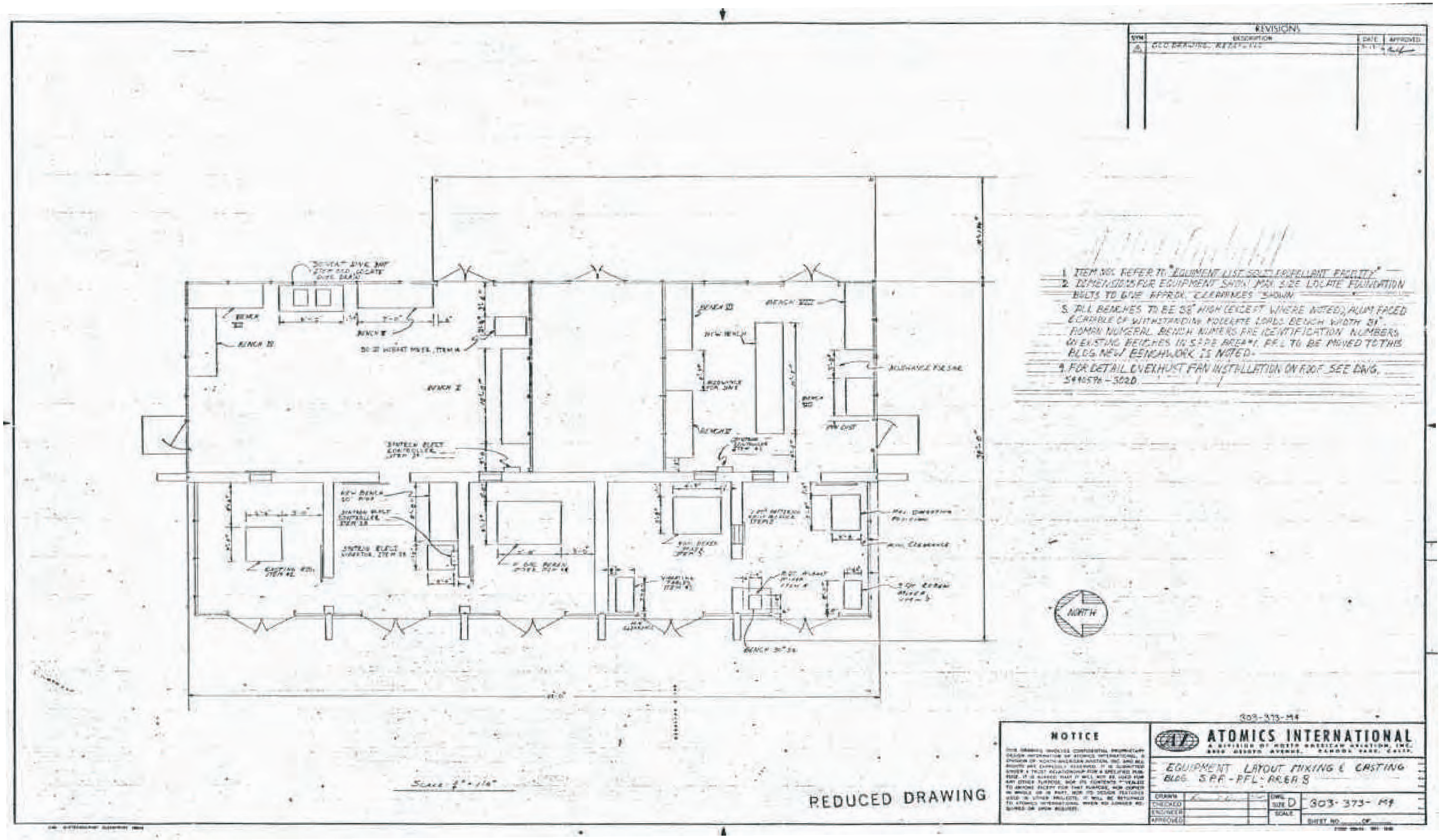

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Source: Boeing Company, 2008

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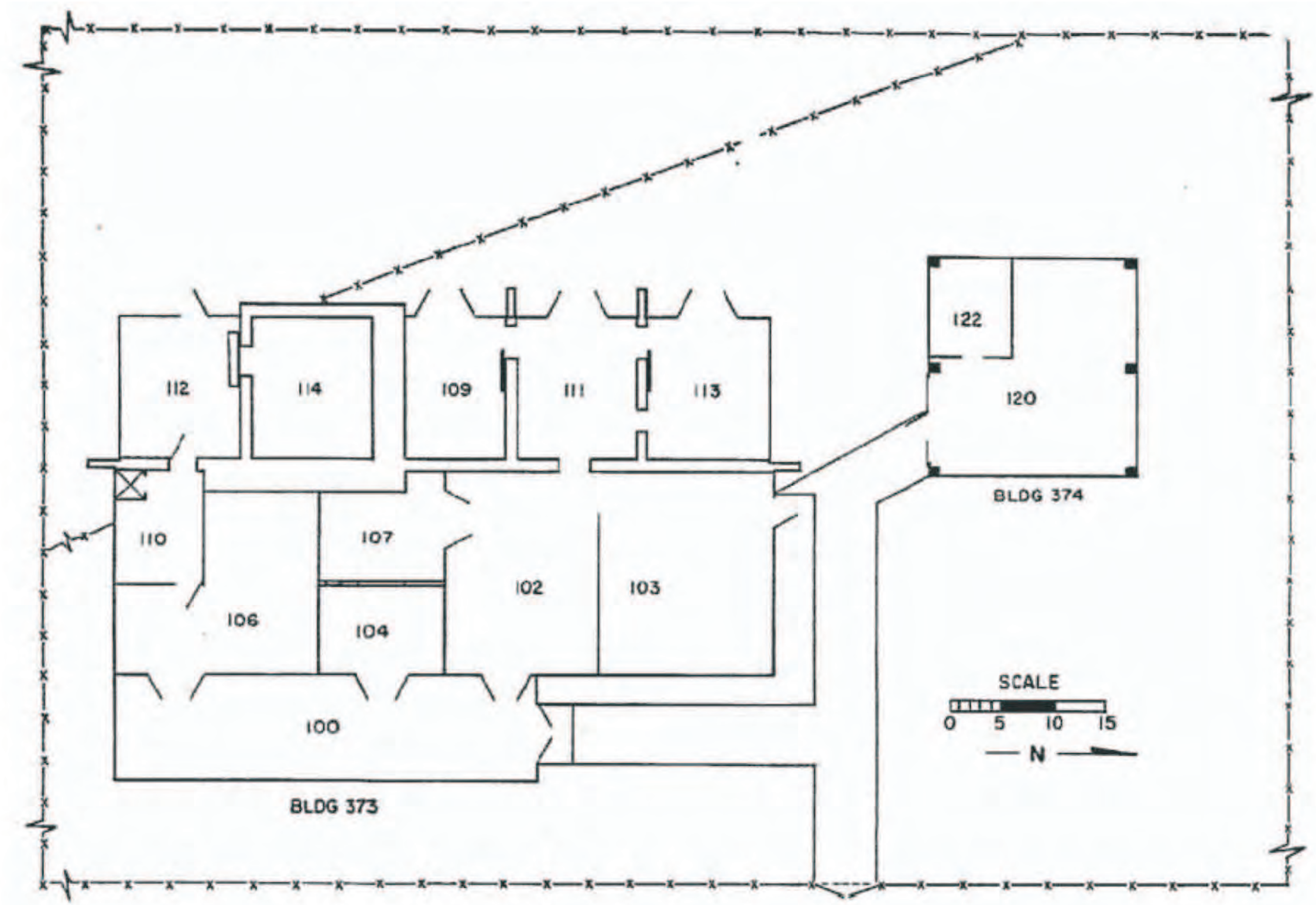
Figure 2.2.5c
Building 4373
Equipment Layout
Mixing and Casting
Building



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Source: Boeing Company, 2008

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Figure 2.2.5d
Building 4373
SNAP Critical
Facility Layout
1962

Redacted

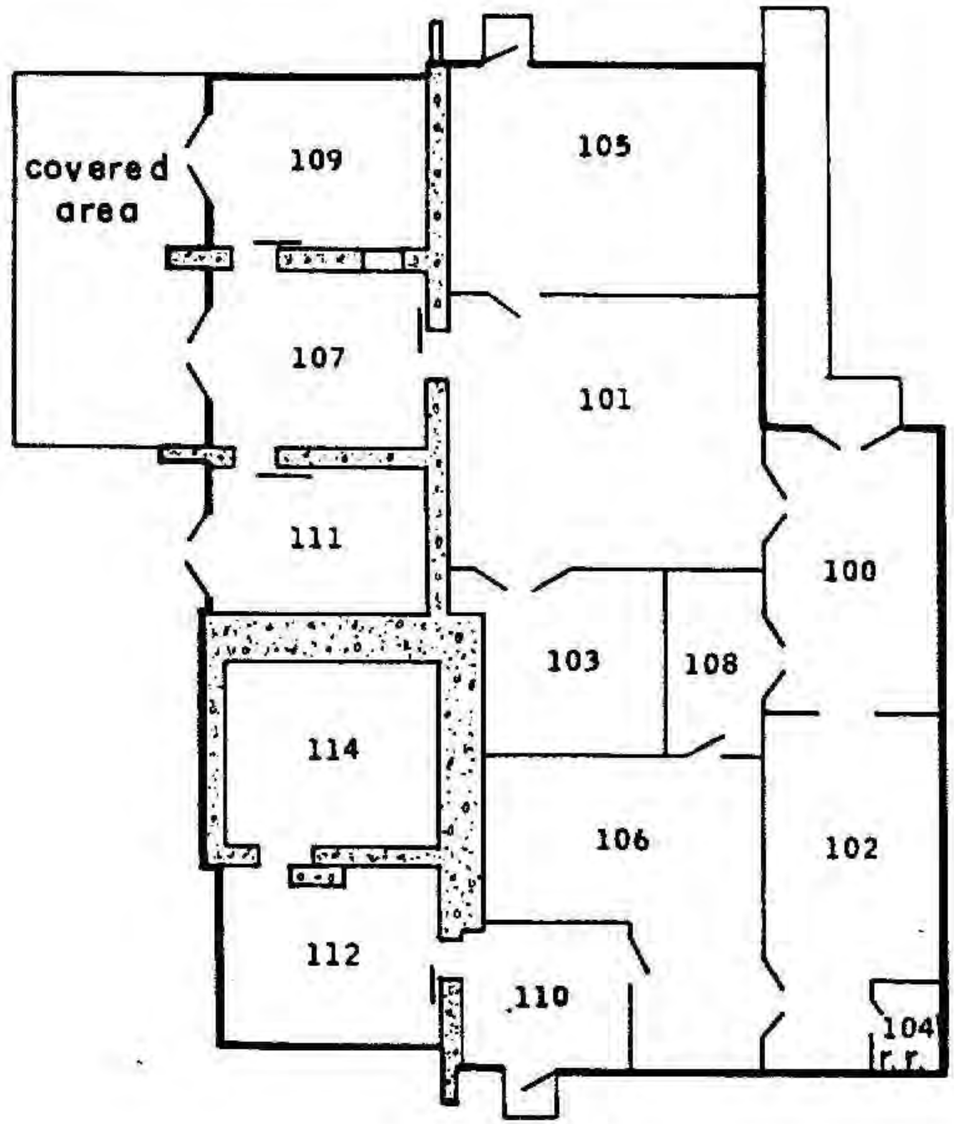

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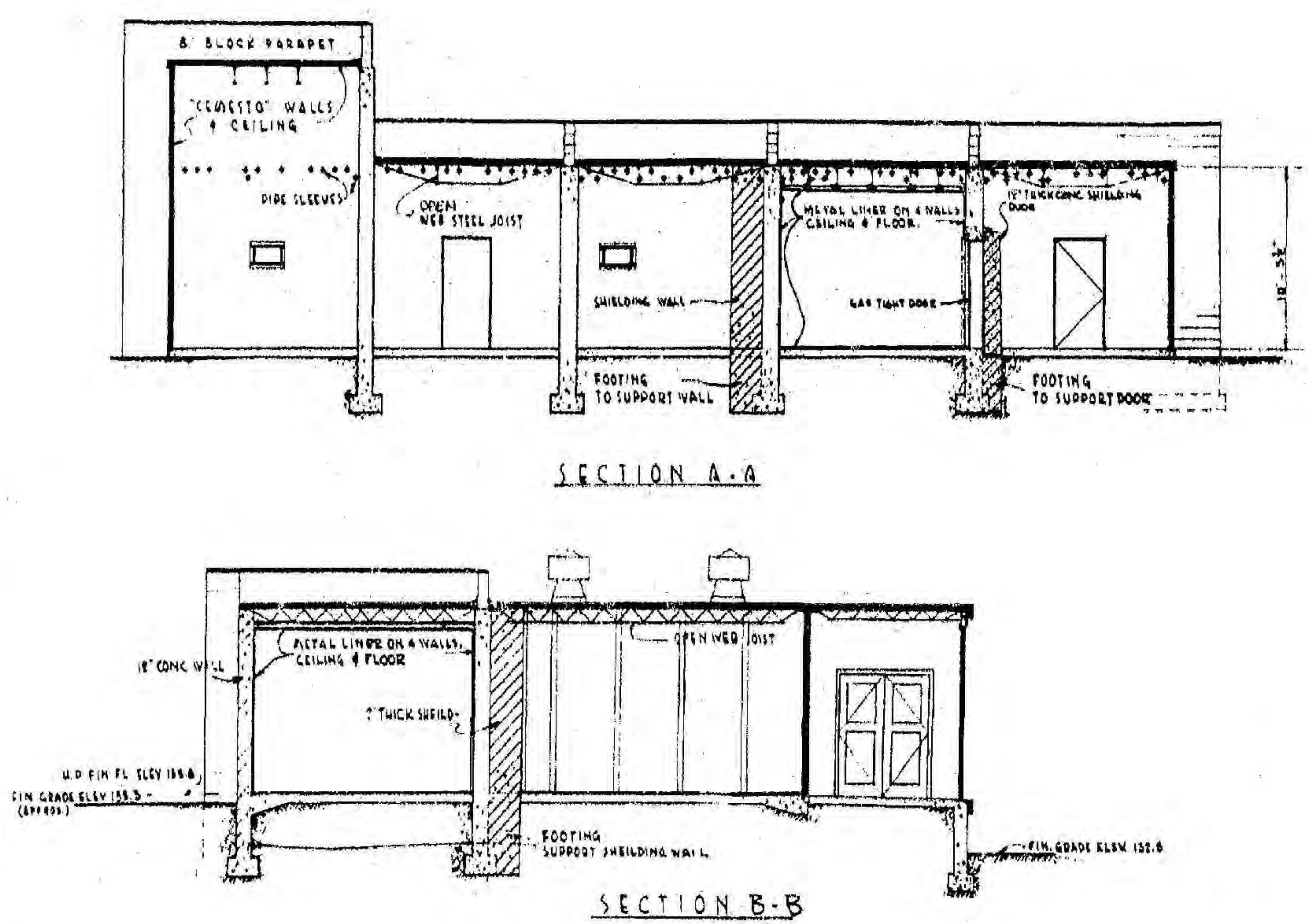
Figure 2.2.5e
Building 4373
SNAP Critical
Facility Layout
1969

Redacted



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Source: Boeing Company, 2008

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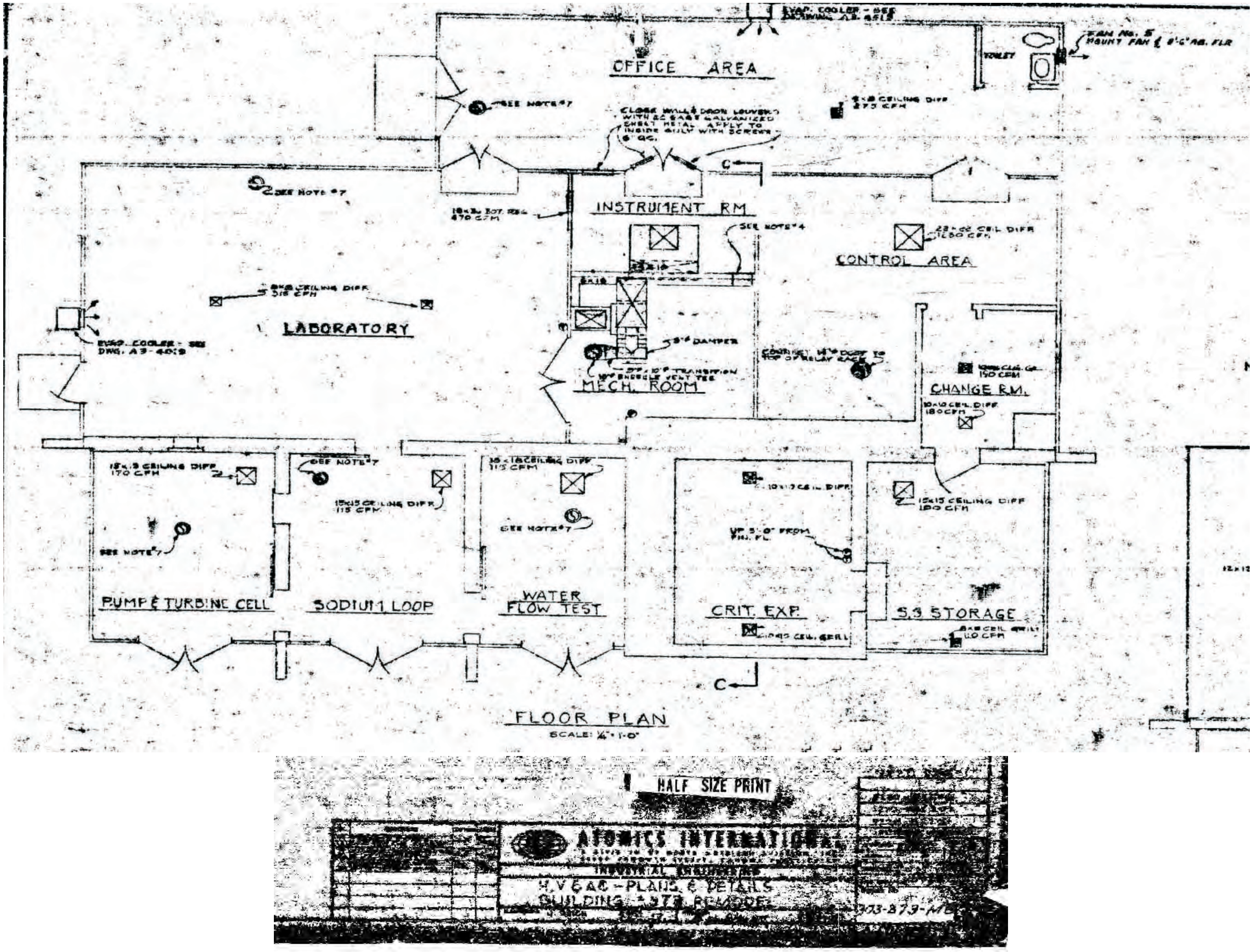
Figure 2.2.5f
Building 4373
Sectional View



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Source: Boeing Company, 2008

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Figure 2.2.5g
Building 4373
HV&AC Plans
and Details

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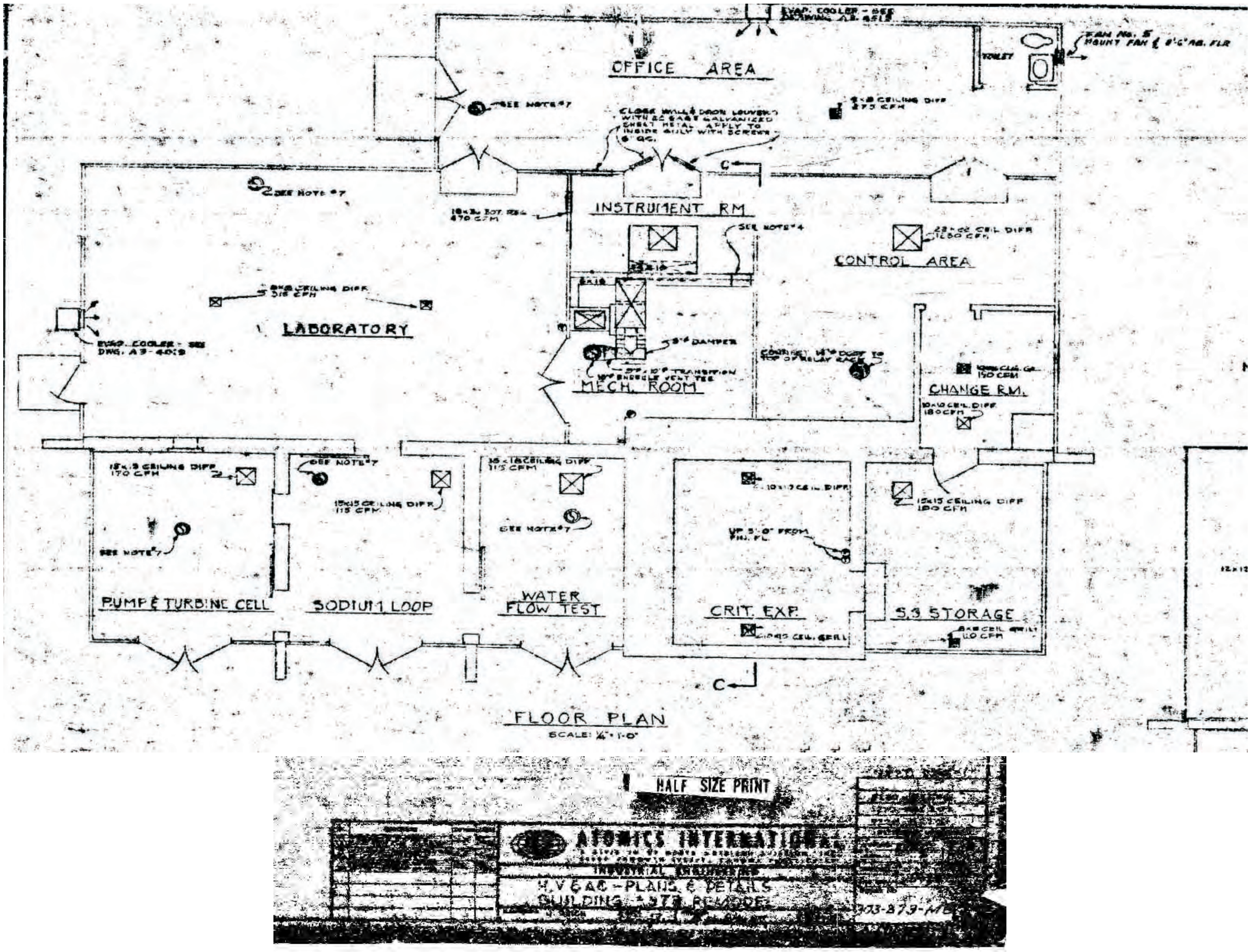

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Source: Boeing Company, 2008

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Figure 2.2.5h
Building 4373
Mercury Test
Loop Installation

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Figure 2.2.5i
Building 4373
1999 Aerial Oblique

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Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

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Figure 2.2.6a
Building 4374
Site Photograph

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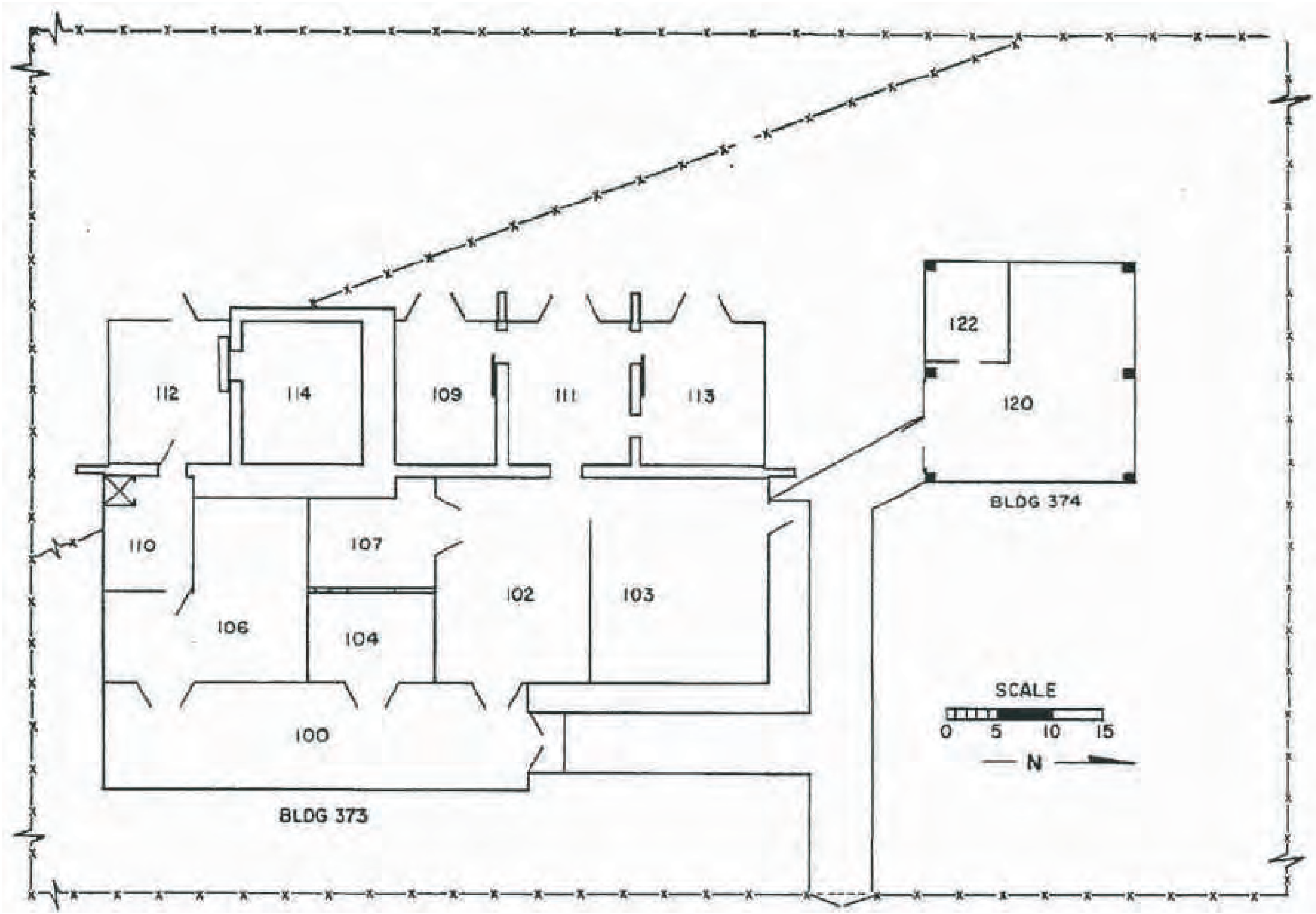

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Figure 2.2.6b
Building 4374
Floor Plan

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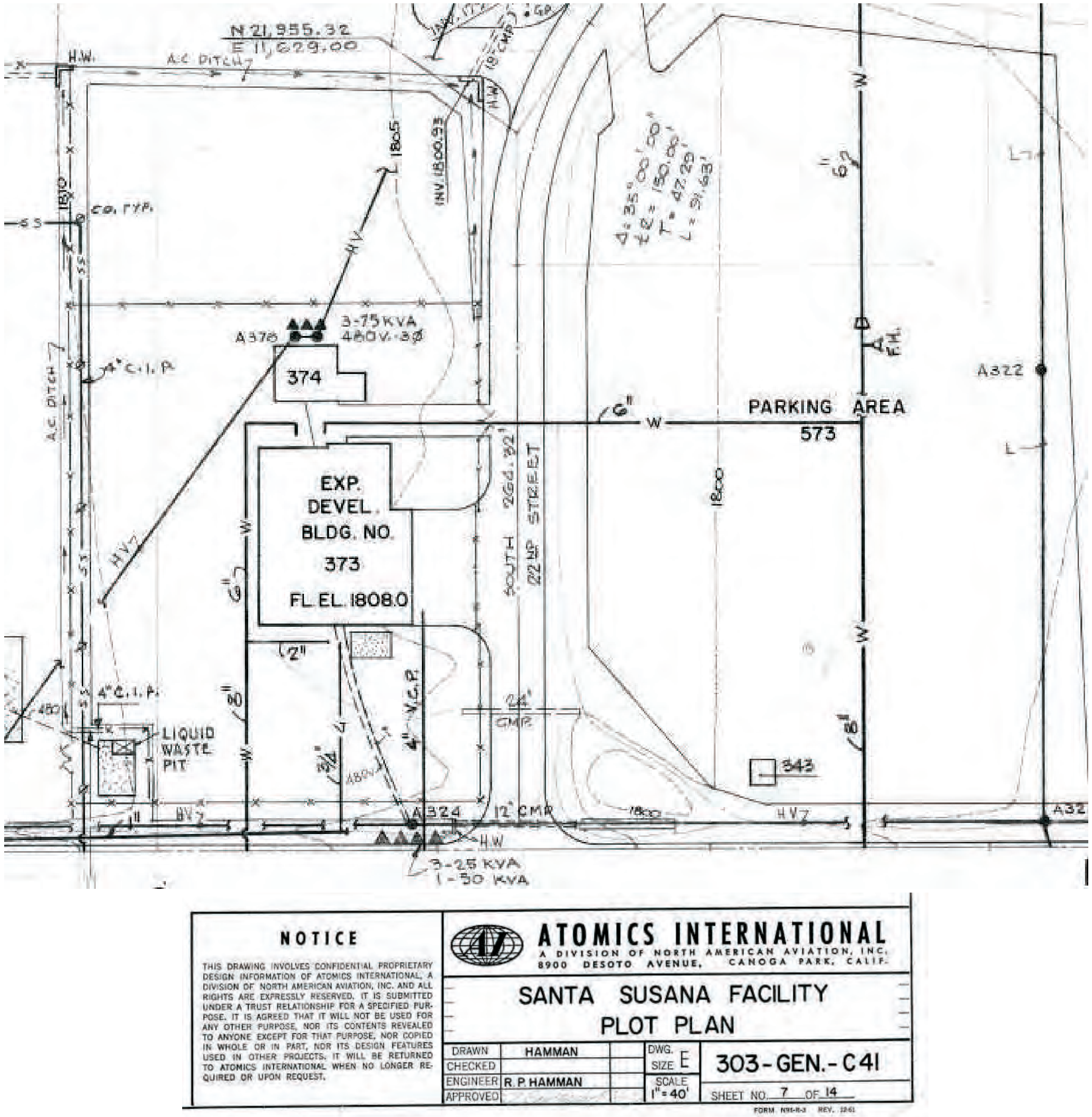

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Source: Boeing Company, 2008

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Figure 2.2.6c
Building 4374
Plot Plan

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Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

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Figure 2.2.7a
Building 4173(4865)
Site Photograph

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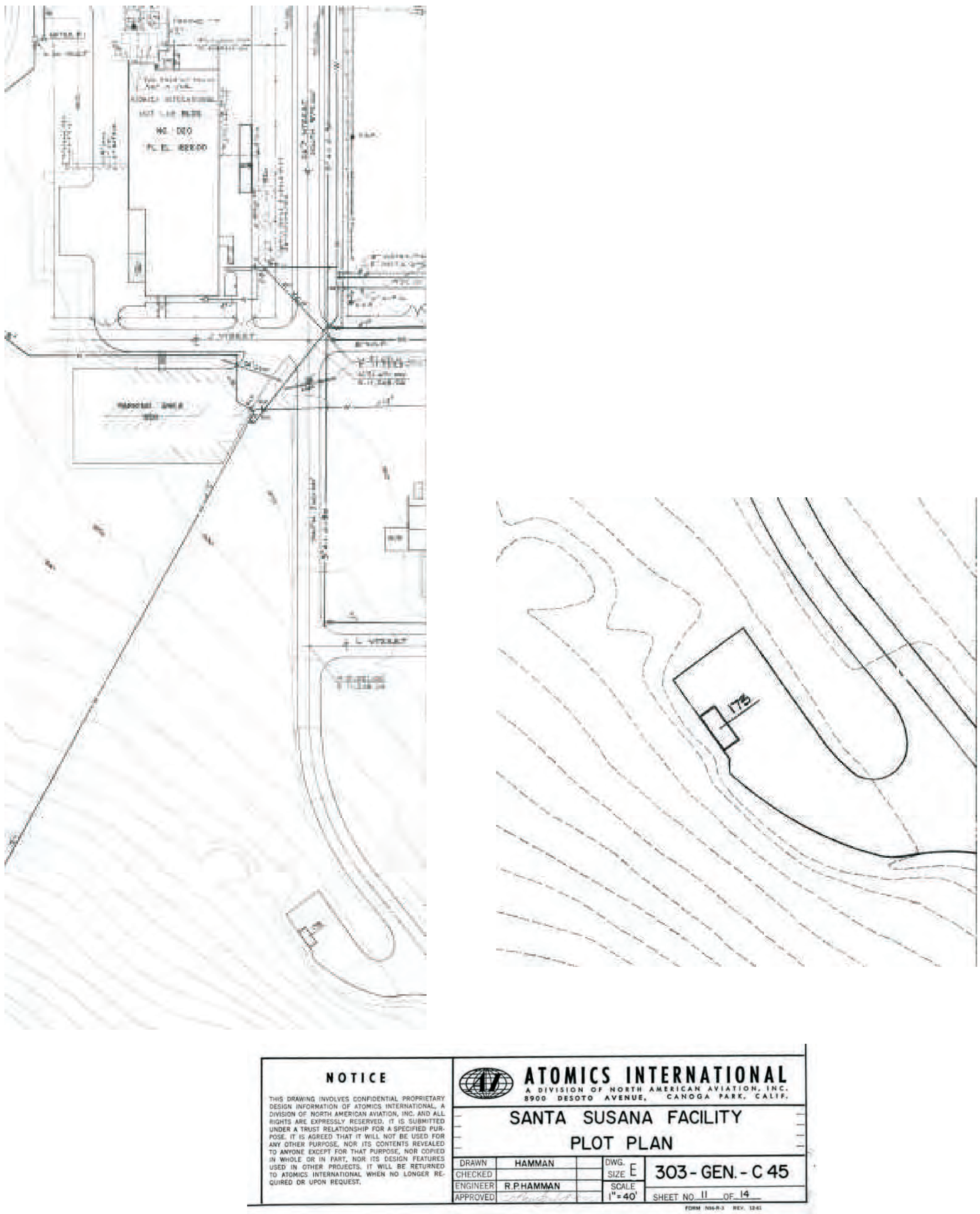

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Figure 2.2.7b
Building 4173(4865)
Plot Plan

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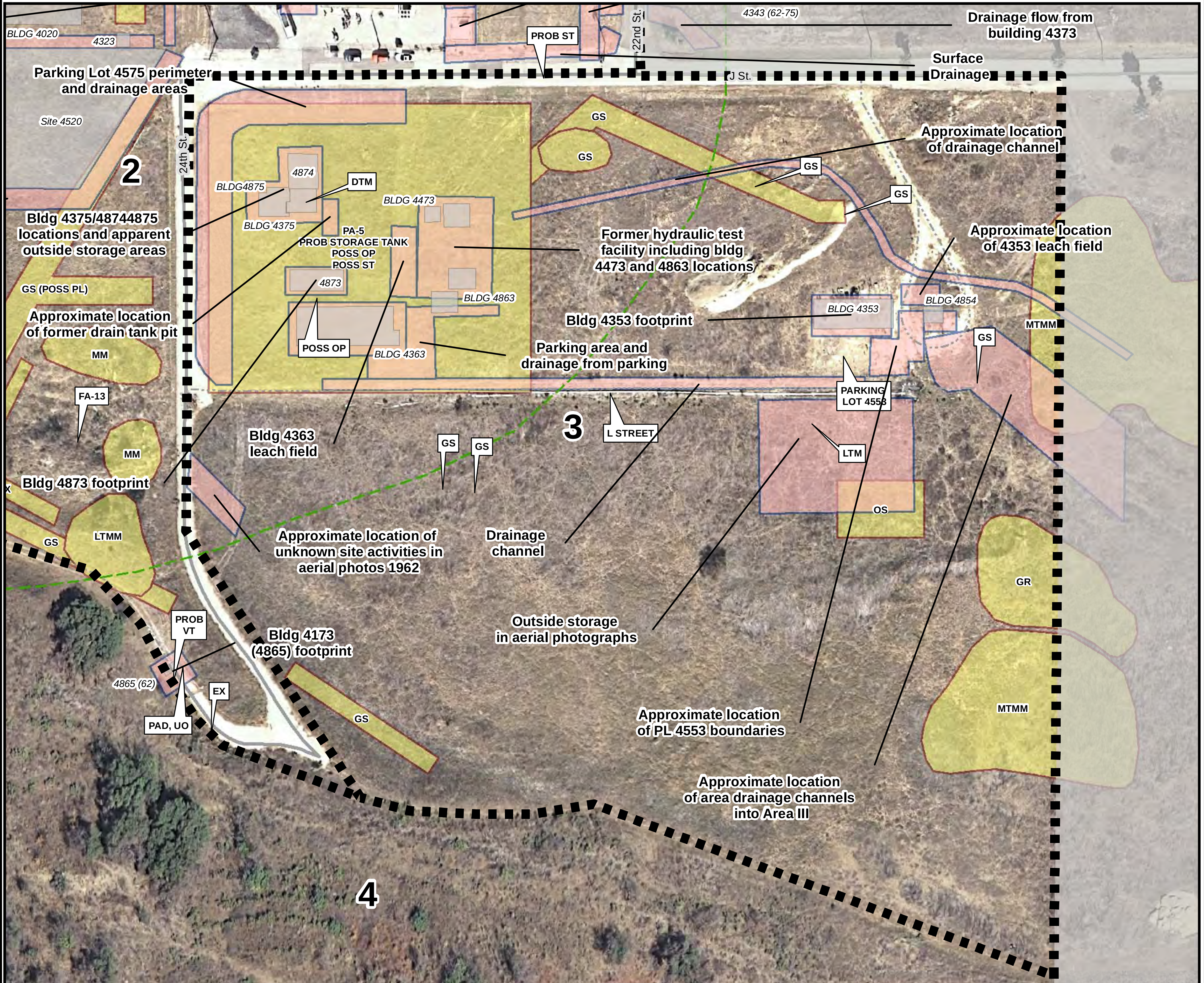

Historical Site Assessment
Final Technical Memorandum - HSA-5D

Figure 2.3
Area IV Subarea 5D-3
Santa Susana Field Laboratory

U.S. EPA Region 9

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Legend

Subarea 5D-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
Proposed Sampling Locations
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

0 25 50 100
Scale In Feet

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12/1/2011 tjansen
Sorce: Boeing Company, 2008
CIRGIS, 2007

HGL HydroGeoLogic, Inc

Redacted

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Revised: 03/23/2011 TJ
Source: Boeing Company, 2008*

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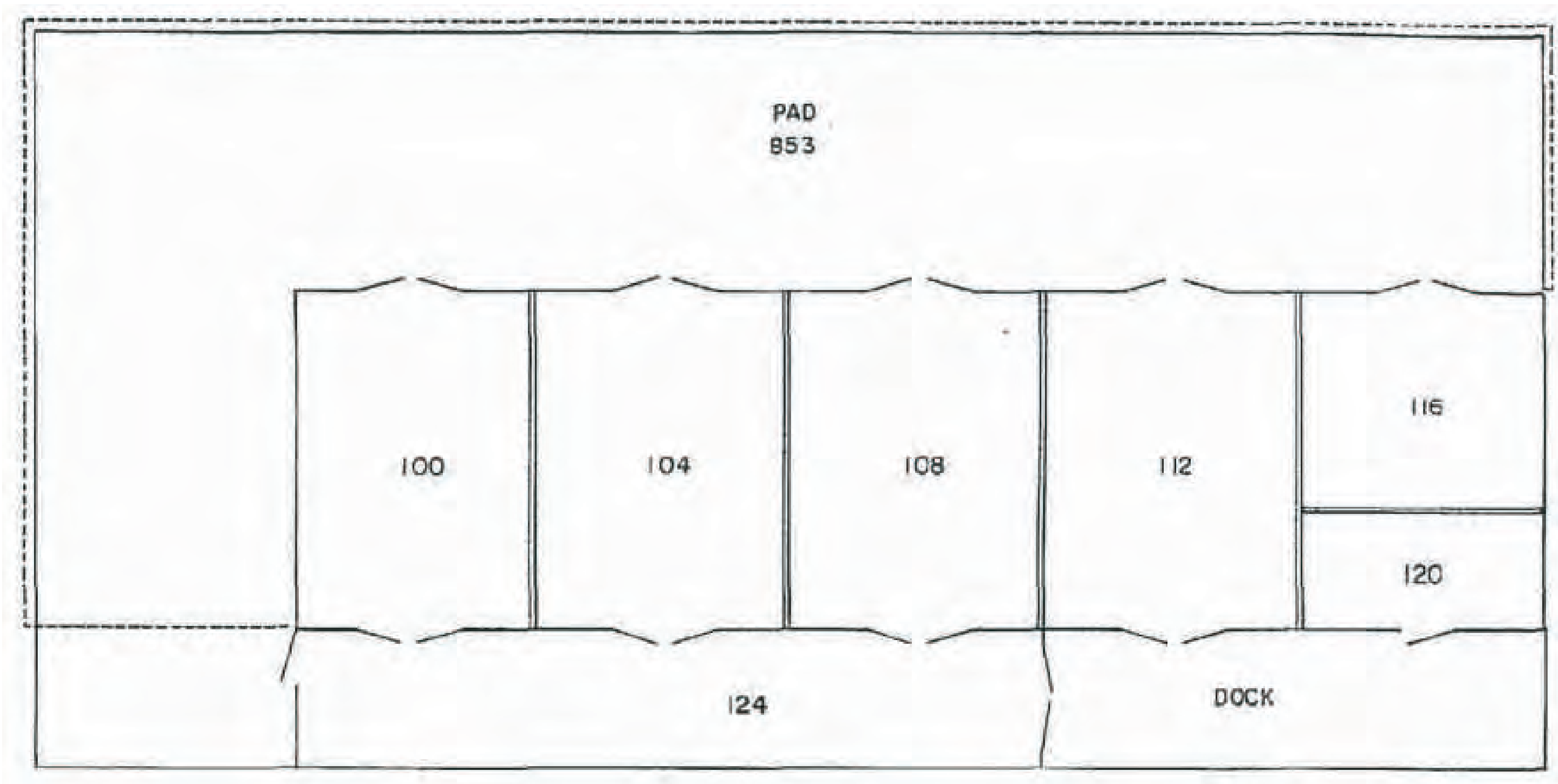
**Figure 2.3.1a
Building 4353
Site Photograph**



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Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

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Figure 2.3.1b
Building 4353
Floor Plan

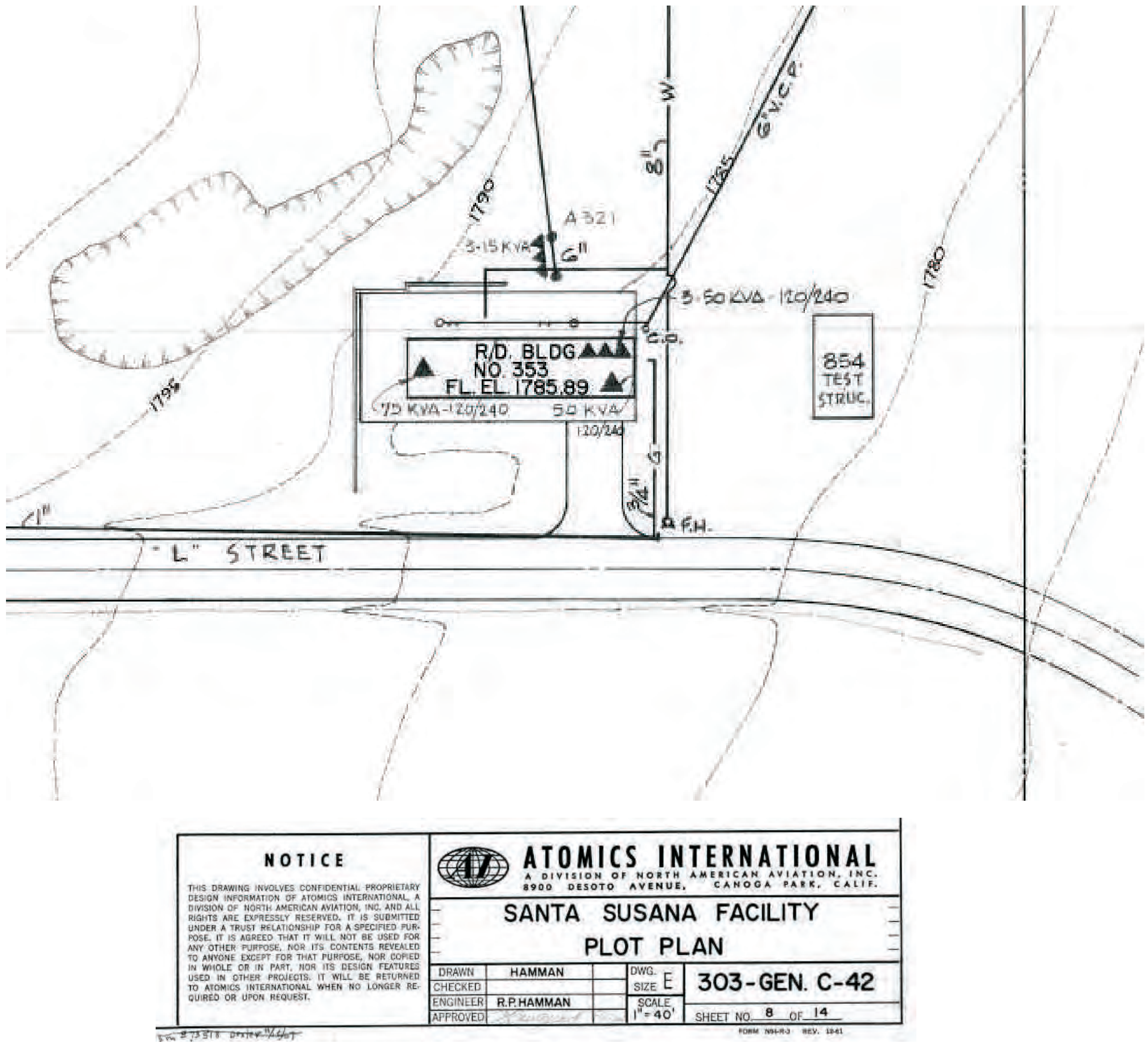

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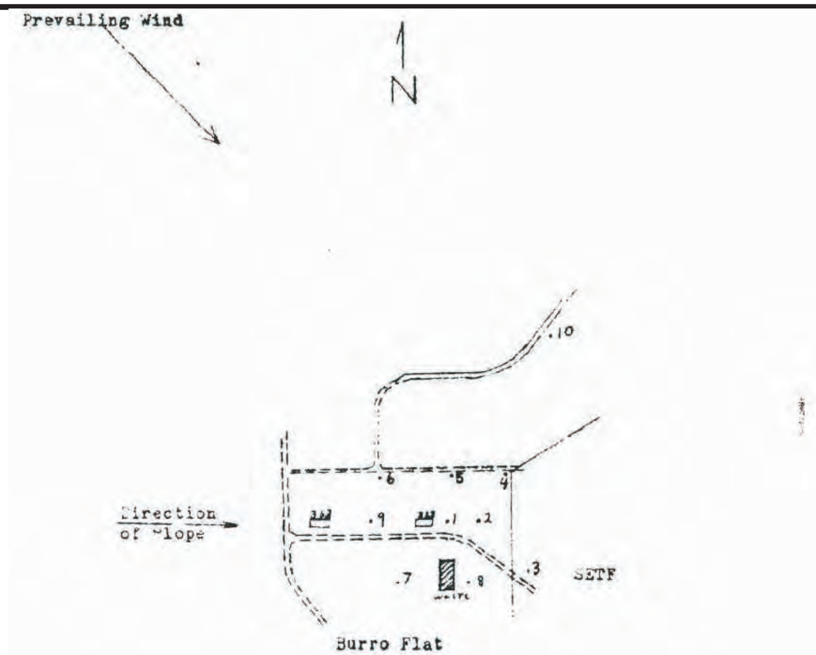
Figure 2.3.1c
Building 4353
Plot Plan



Date 27 February 1959 Location Bldg. 353, Burro Flat SS

	Sample	Station	Volume	αμc gm	β − γμc gm	αμc/cc	β − γμc/cc
UNWASHED	Soil	1	1.0 gm	7.02×10^{-8}	1.44×10^{-5}		
	Veg.		0.3 gm	1.41×10^{-8}	2.44×10^{-4}		
	Soil	3	1.0 gm	1.64×10^{-7}	2.45×10^{-5}		
	Veg		0.3 gm	1.24×10^{-7}	7.61 x 10-4		
	Soil	5	1.0 gm	3.69×10^{-7}	1.94×10^{-5}		
	Veg		0.3 gm	1.81×10^{-7}	7.91×10^{-4}		
	Soil	7	1.0 gm	3.72×10^{-7}	6.54×10^{-5}		
	Veg		0.3 gm	5.40×10^{-8}	5.09×10^{-4}		
	Soil	9	1.0 gm	1.71×10^{-7}	2.05×10^{-5}		
	Veg		0.3 gm	N.A.D.*	5.28×10^{-4}		
WASHED	Soil	2	1.0 gm	2.48×10^{-7}	2.93×10^{-5}		
	Veg		0.3 gm	1.68×10^{-7}	7.76×10^{-4}		
	Soil	4	1.0 gm	1.64×10^{-7}	2.49×10^{-5}		
	Veg		0.3 gm	1.08×10^{-7}	4.31×10^{-3}		
	Soil	6	1.0 gm	4.05×10^{-7}	1.40×10^{-5}		
	Veg		0.3 gm	N.A.D.	5.69×10^{-4}		
	Soil	8	1.0 gm	2.57×10^{-7}	6.98×10^{-5}		
	Veg		0.3 gm	4.00×10^{-7}	6.11×10^{-4}		
	Soil	10	1.0 gm	4.72×10^{-8}	1.73×10^{-5}		
	Veg		0.3 gm	N.A.D.	6.78×10^{-4}		

*=no activity detected

730-F-16

Odd numbered samples were processed without washing.
Even numbered samples were washed.

[signature] Surveyor

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-1d)BldgSS.cdr
Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.1d
Building 4353
1959 Special Survey

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-2a)Bldg4553SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.2a
Parking Lot 4533
Site Photograph

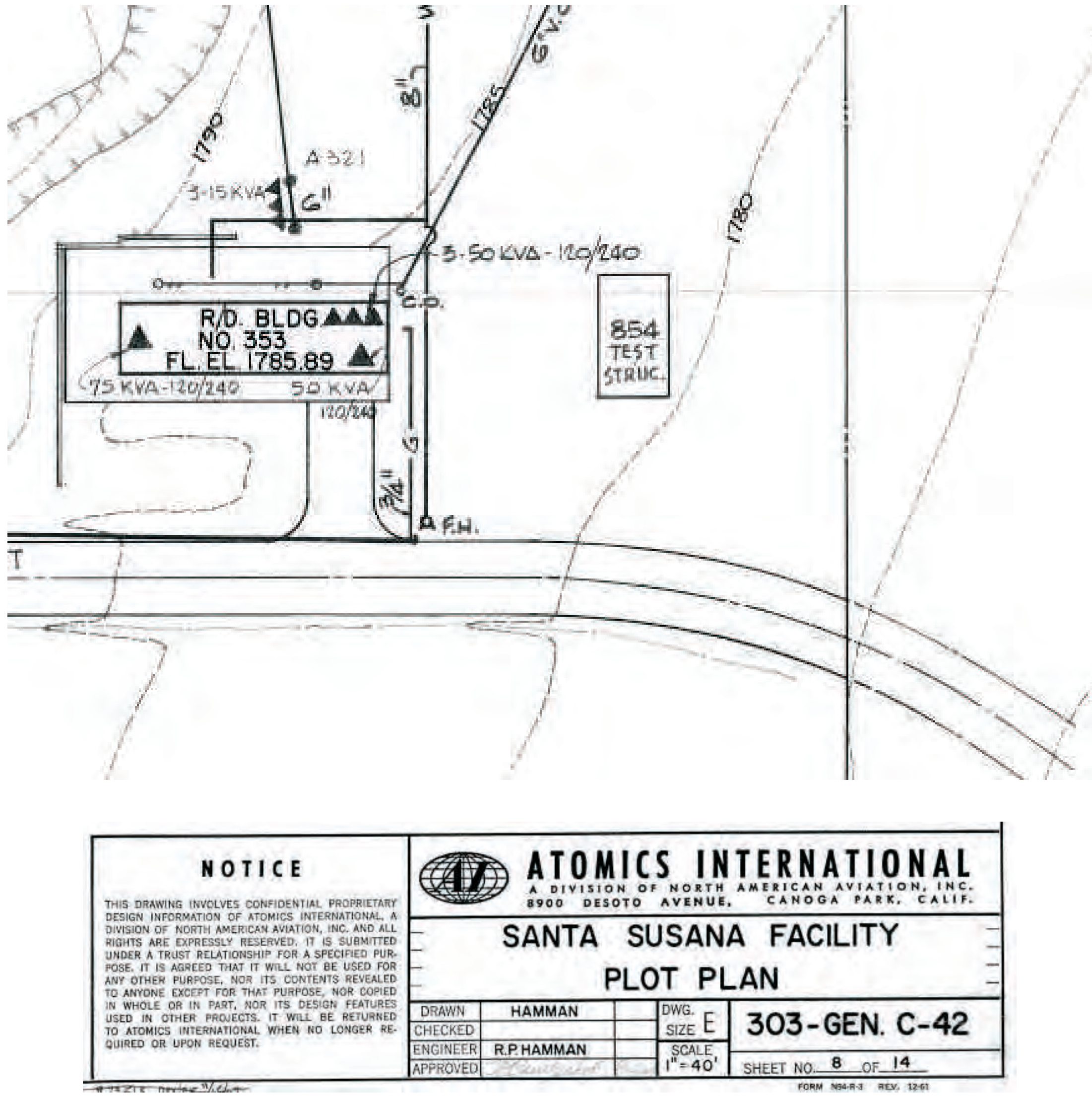
Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-3a)Bldg4854SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.3a
Building 4854
Site Photograph

Redacted



Y:/Santa_Susana/EP9038/TM/HSA_5D
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Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.3b
Building 4854
Plot Plan

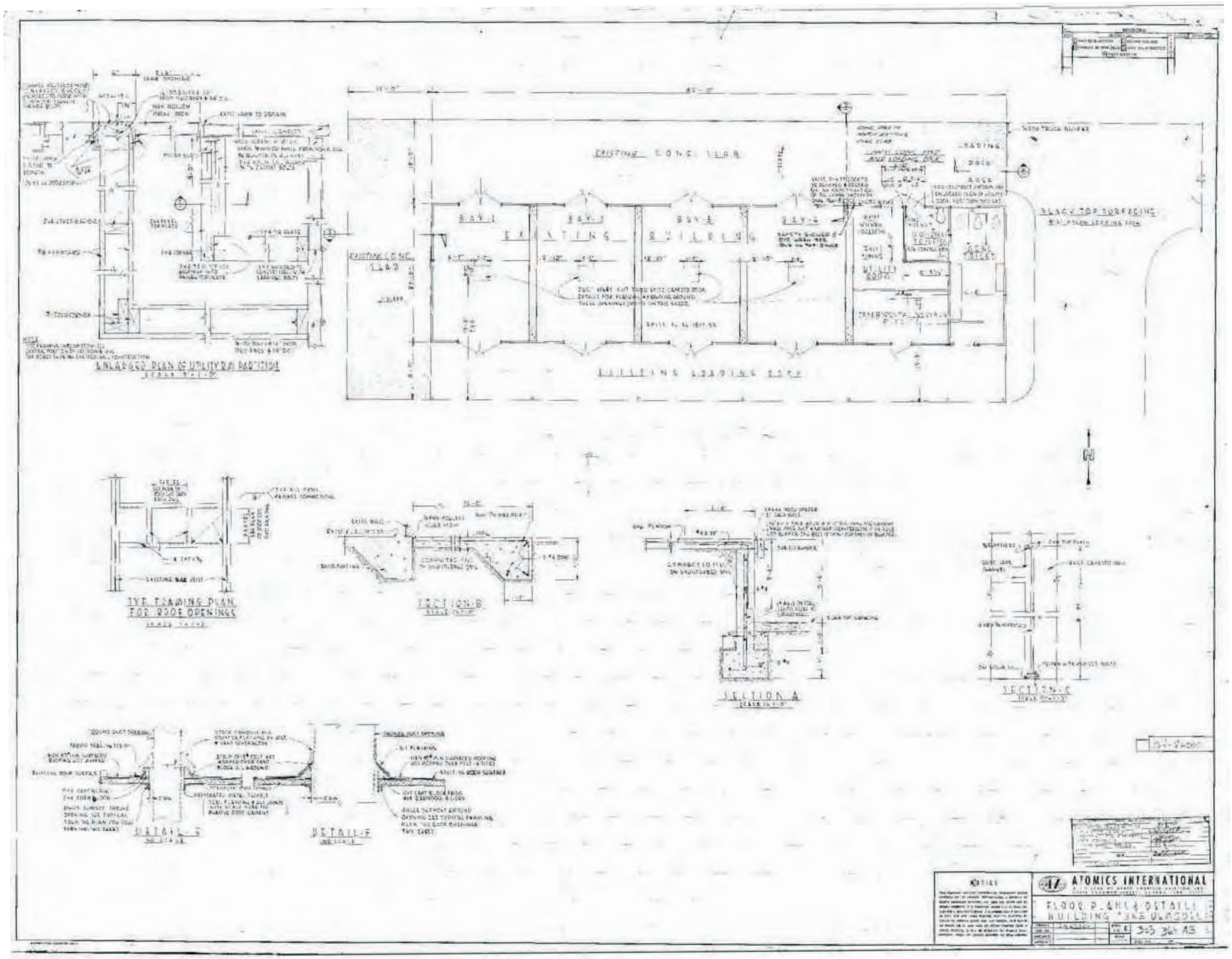
Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-4a)Bldg4363SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.4a
Building 4363
Site Photograph

Redacted

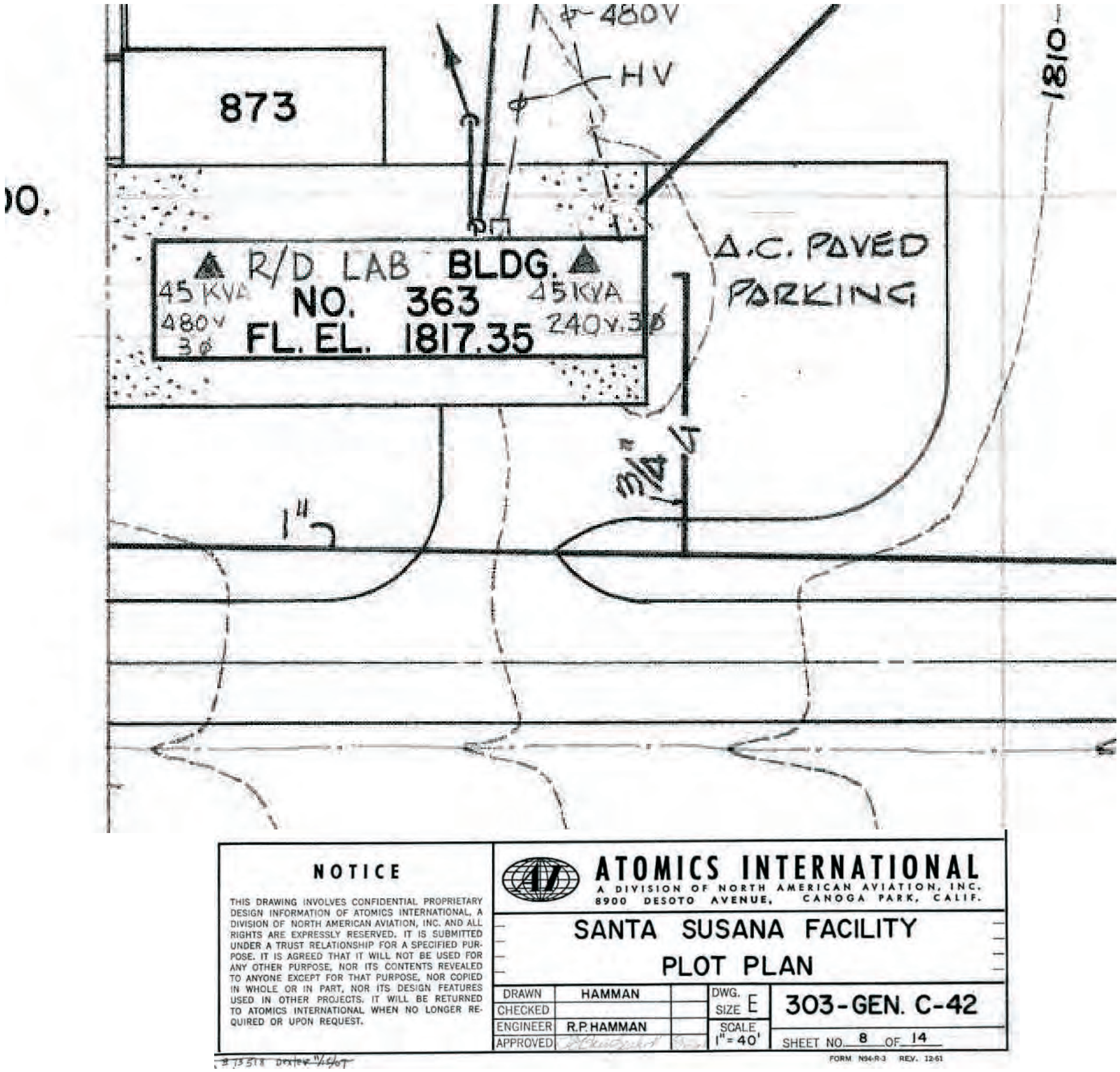


Y:/Santa_Susana/EP9038/TM/HSA_5D (2-3-4b)Bldg4363FP.cdr
Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.4b
Building 4363
Floor Plan

Redacted



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(2-3-3b)Bldg4363PP.cdr
Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

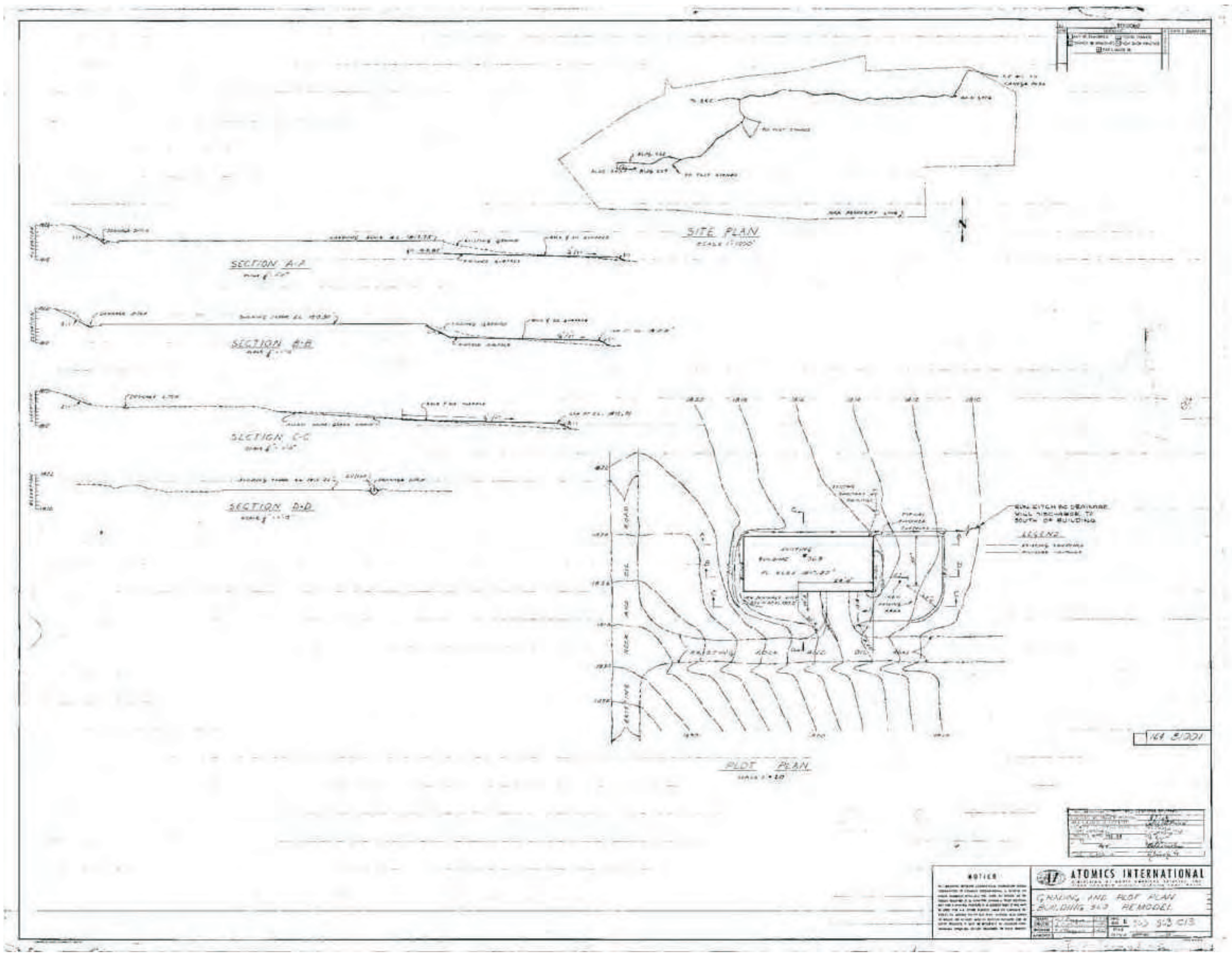
Figure 2.3.4c
Building 4363
Plot Plan

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-4d)Bldg4363SP.cdr
Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.4d
Building 4363
Undated Site
Photographs

Redacted



Y:/Santa_Susana/EP9038/TM/HSA_5D
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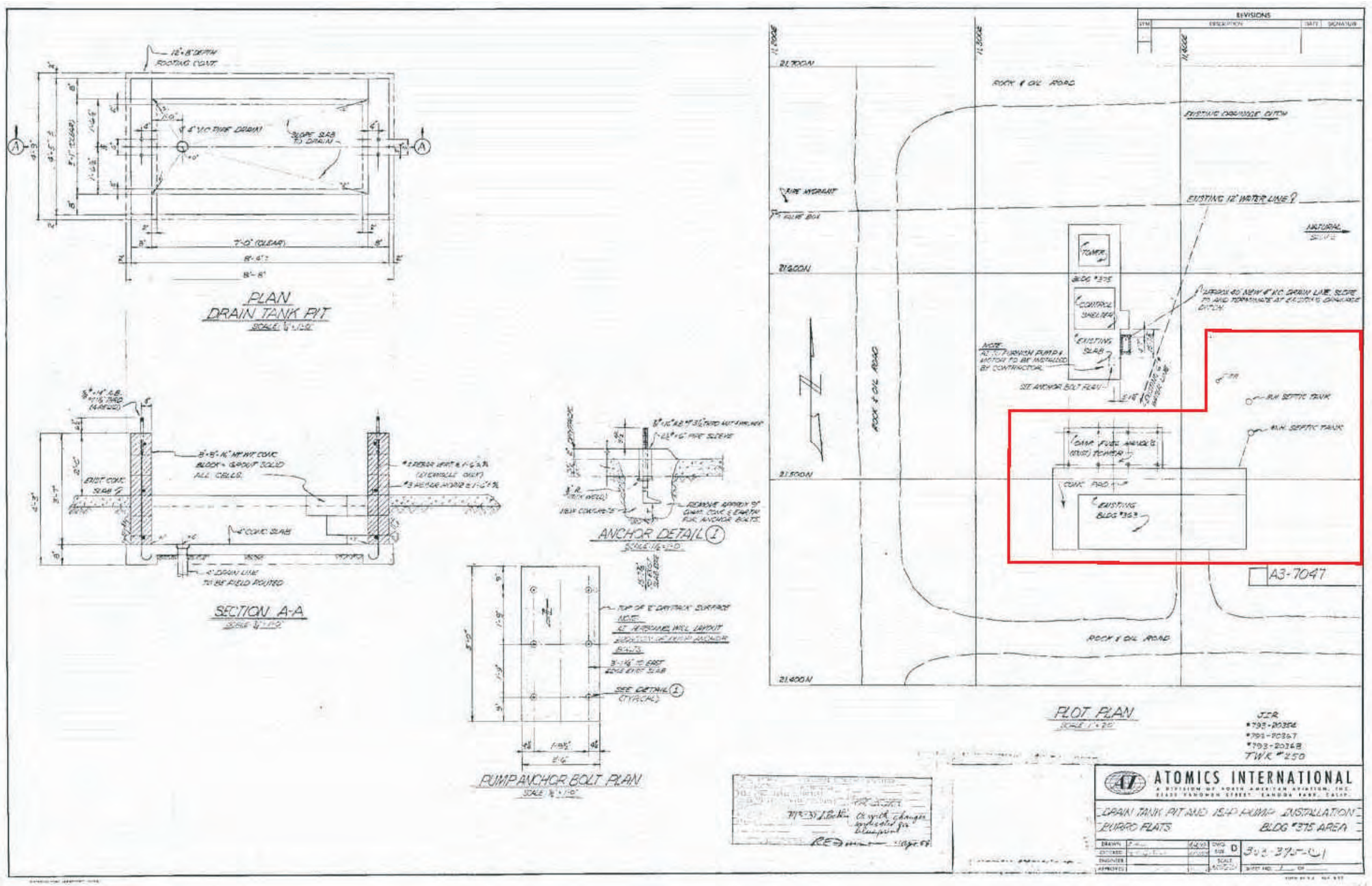
Project:EP9038
Revised: 03/22/2011 RB
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.4e
Building 4363
Drainage

Redacted



Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-4f)Bldg4363LeachField_SepticTank_
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Project:EP9038
Revised: 03/22/2011 RB
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.4f
Building 4363
Leach Field and
Septic Tank Location

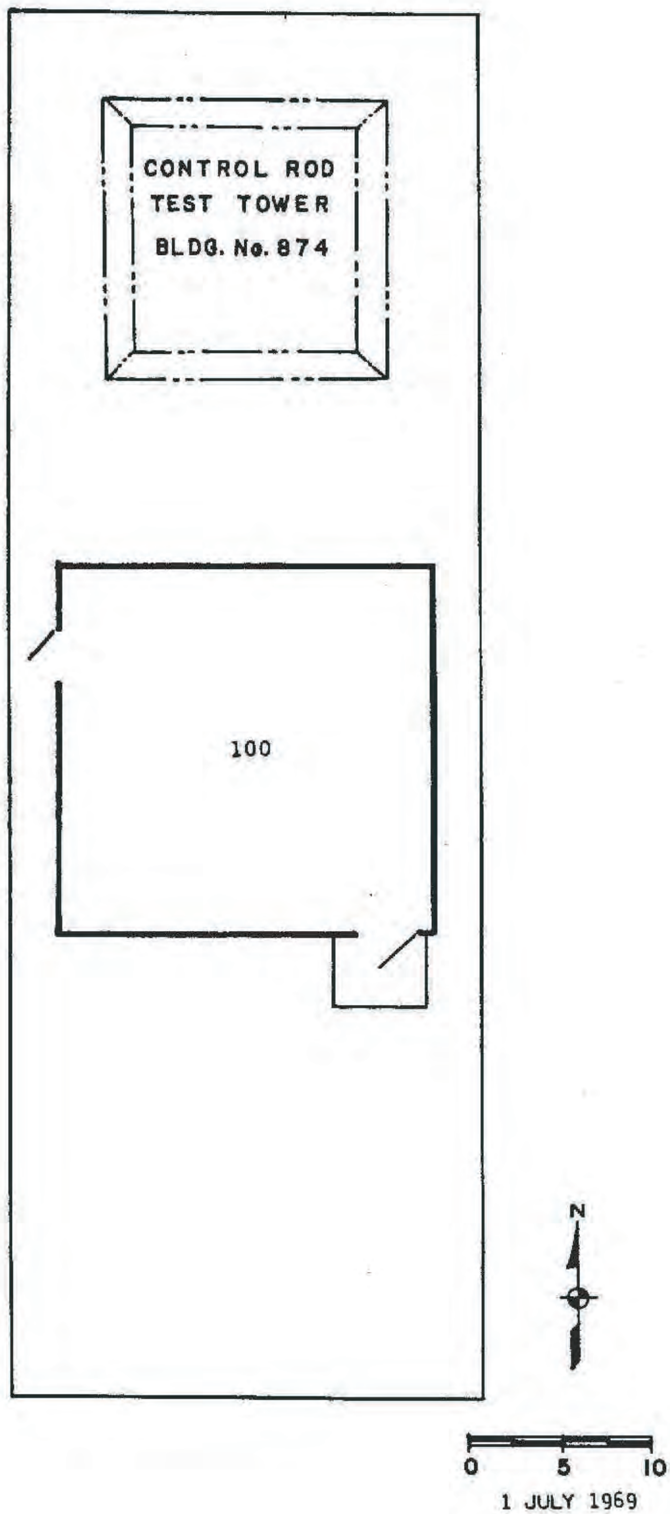
Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-5a)Bldg4375SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.5a
Building 4375
Site Photograph

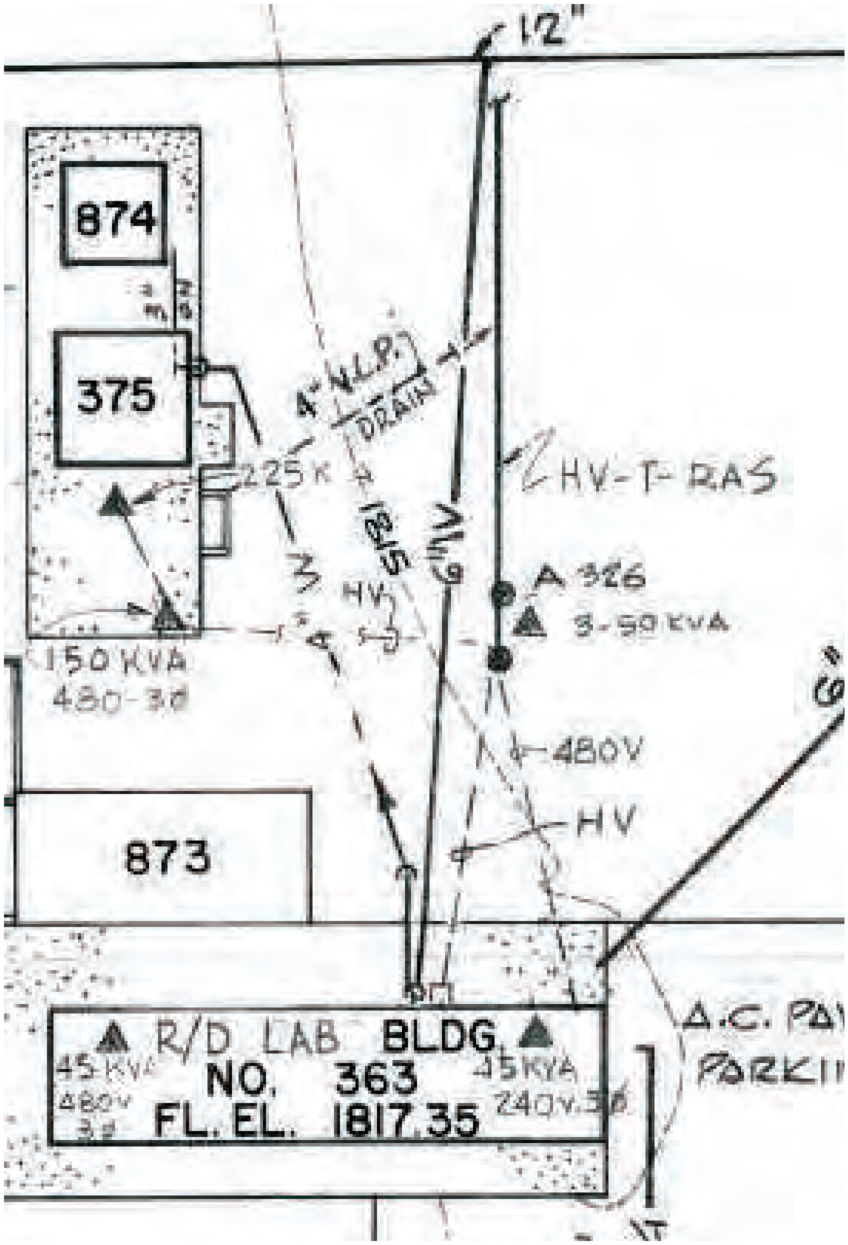
Redacted



Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-5b)BldgFloorPlan.cdr
Project:EP9038
Revised: 03/22/2011 RB
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.5b
Building 4375
Floor Plan



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8900 DESOTO AVENUE, CANOGA PARK, CALIF.

SANTA SUSANA FACILITY
PLOT PLAN

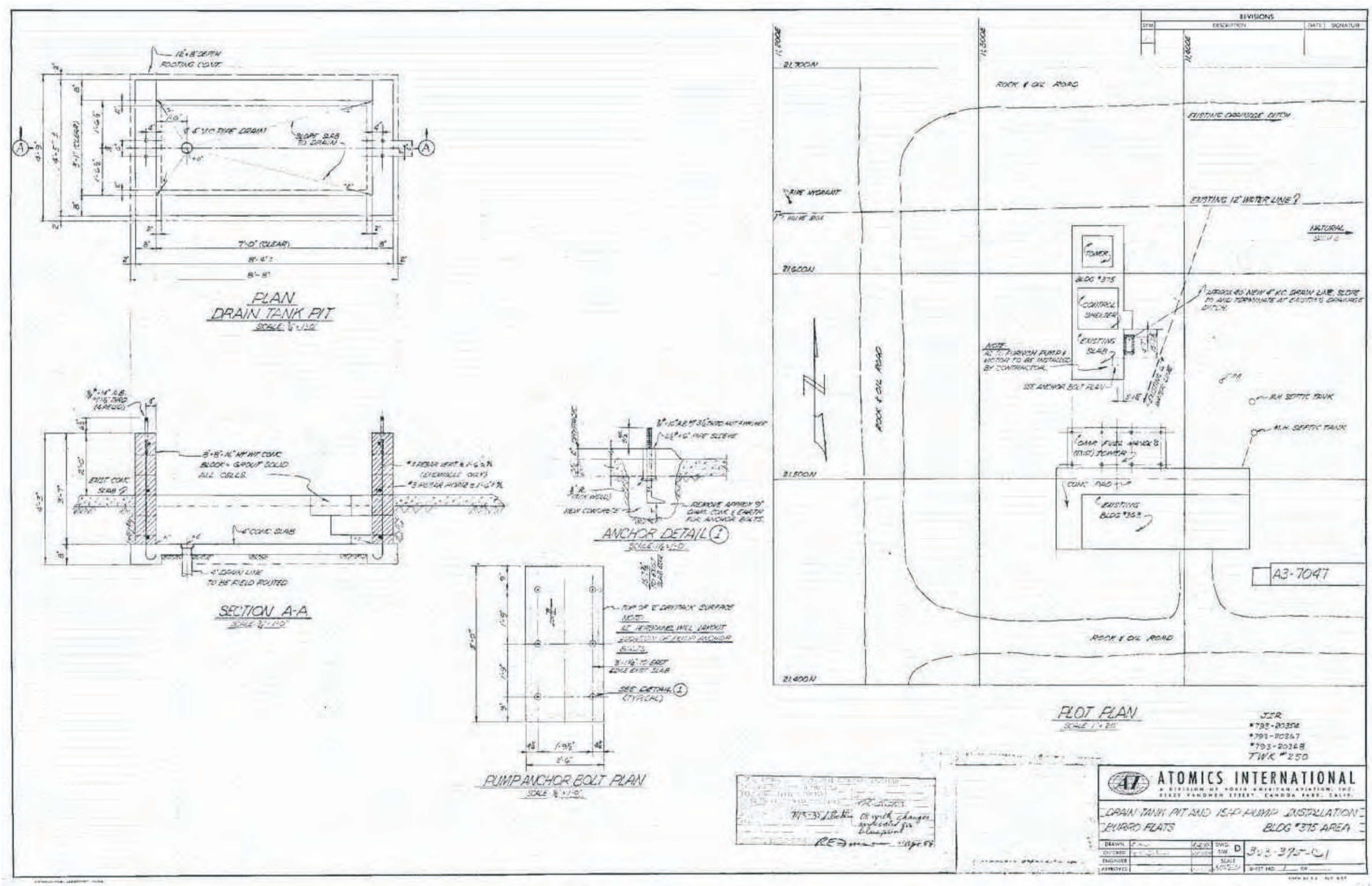
DRAWN	HAMMAN	DWG. SIZE E	303-GEN. C-42
CHECKED			
ENGINEER	R.P. HAMMAN	SCALE 1" = 40'	
APPROVED			SHEET NO. 8 OF 14

FORM N94-R-3 REV. 12-61

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-5c)BldgPlotPlan.cdr
Project:EP9038
Revised: 03/22/2011 RB
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.5c
Building 4375
Plot Plan



Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-5d)Bldg4375DrainTankPitPump
Installation.cdr
Project:EP9038
Revised: 03/22/2011 RB
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.5d
Building 4375
Drain Tank Pit and
Pump Installation

Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-6a)ParkingLot4575SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.6a
Parking Lot 4575
Site Photograph

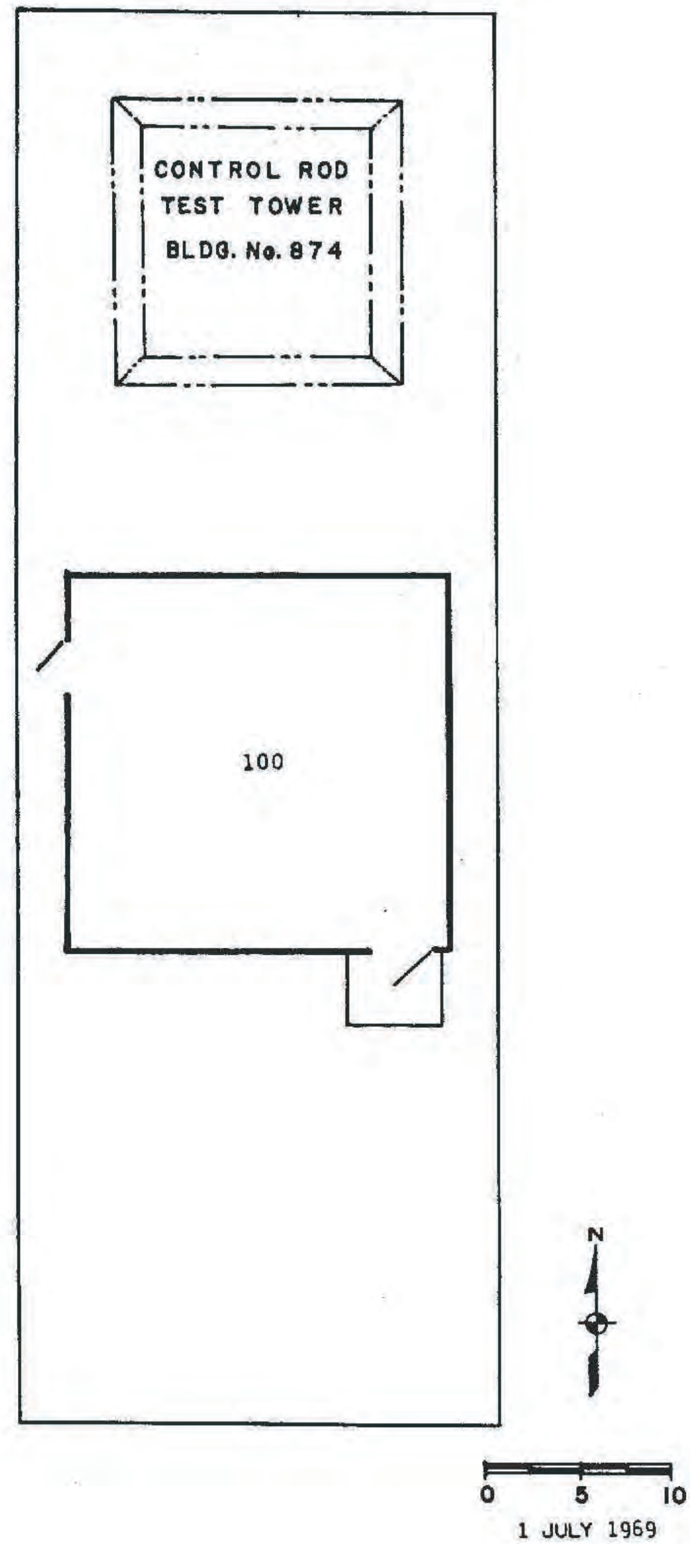
Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-7a)Bldg4874SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.7a
Building 4874
Site Photograph

Redacted



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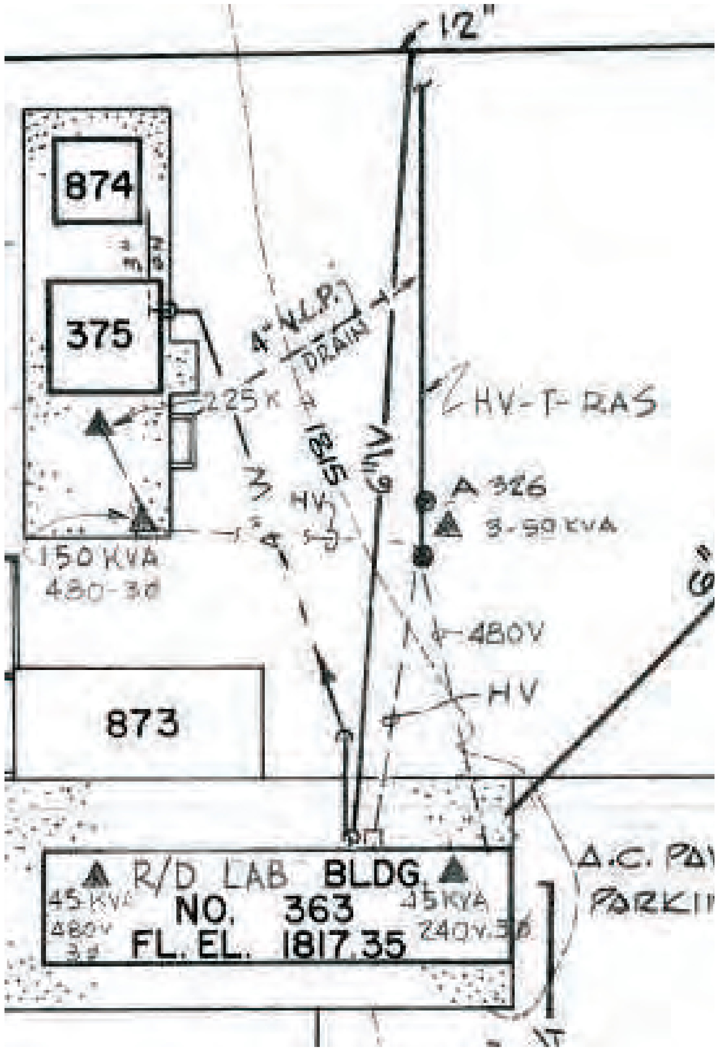
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.7b
Building 4874
Floor Plan



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SANTA SUSANA FACILITY
PLOT PLAN

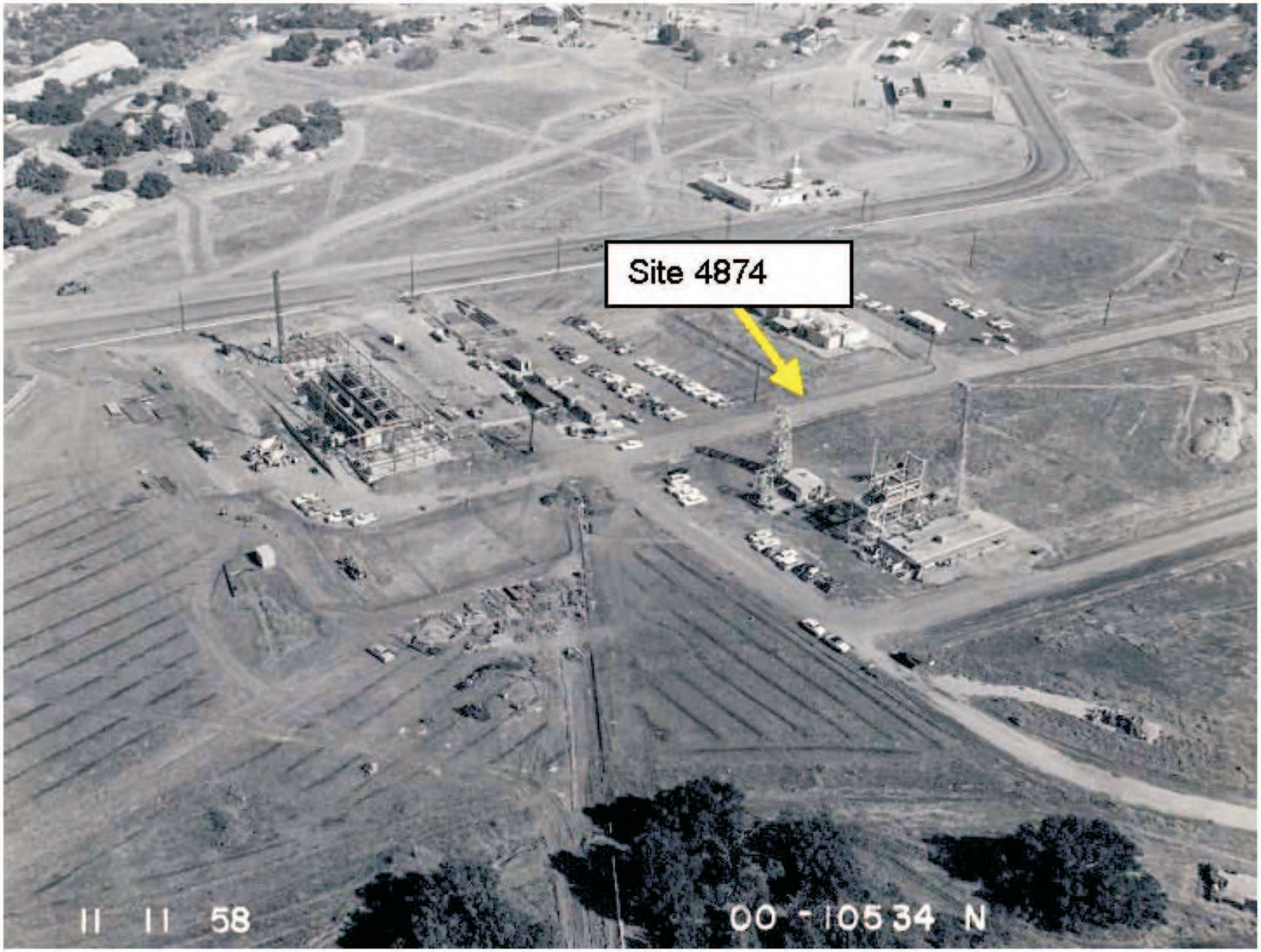
DRAWN	HAMMAN	DWG. SIZE E	303-GEN. C-42
CHECKED			
ENGINEER	R.P. HAMMAN	SCALE 1" = 40'	
APPROVED			SHEET NO. 8 OF 14

FORM N94-R-3 REV. 12-61

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-7c)Bldg4874PP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.7c
Building 4874
Plot Plan



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Installation.cdr
Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

**Figure 2.3.7d
Building 4874
Aerial Oblique
Photograph 1958**

Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
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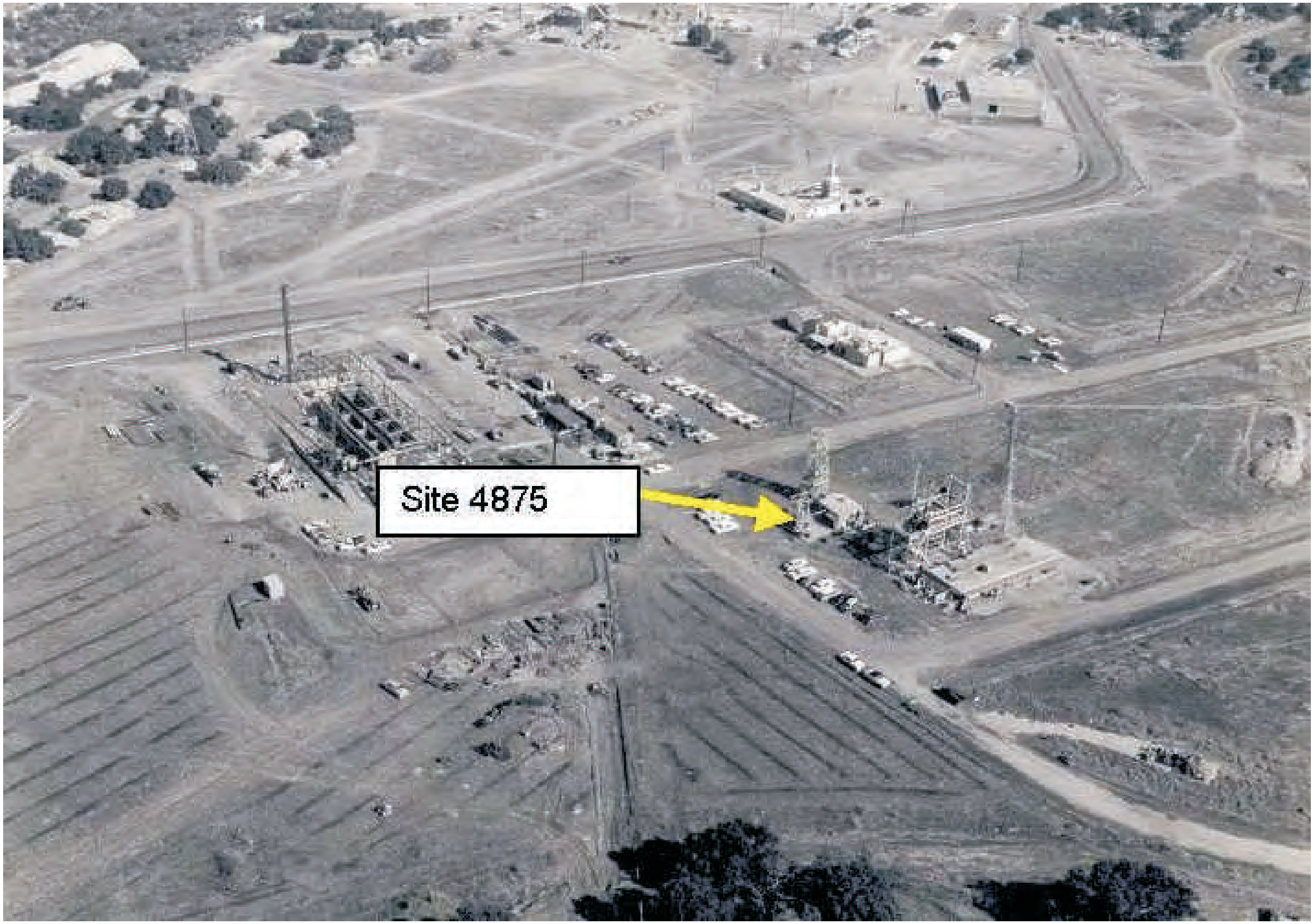
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.8a
Building 4875
Site Photograph

Redacted



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Installation.cdr
Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.8b
Building 4875
Aerial Oblique
Photograph 1958

Redacted

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-9a)Bldg4473SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.9a
Building 4473
Site Photograph

Redacted

Looking East

Looking South

Looking North

Looking West

*Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-9b)Bldg4473FP.cdr
Installation.cdr
Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008*

U.S. EPA Region 9

**Figure 2.3.9b
Building 4473
Facility Photographs**

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-10a)Bldg4863SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.10a
Building 4863
Site Photograph

Redacted

Looking East

Looking South

Looking North

Looking West

Y:/Santa_Susana/EP9038/TM/HSA_5D (2-3-10b)Bldg4863FP.cdr Installation.cdr
Project:EP9038
Revised: 03/22/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

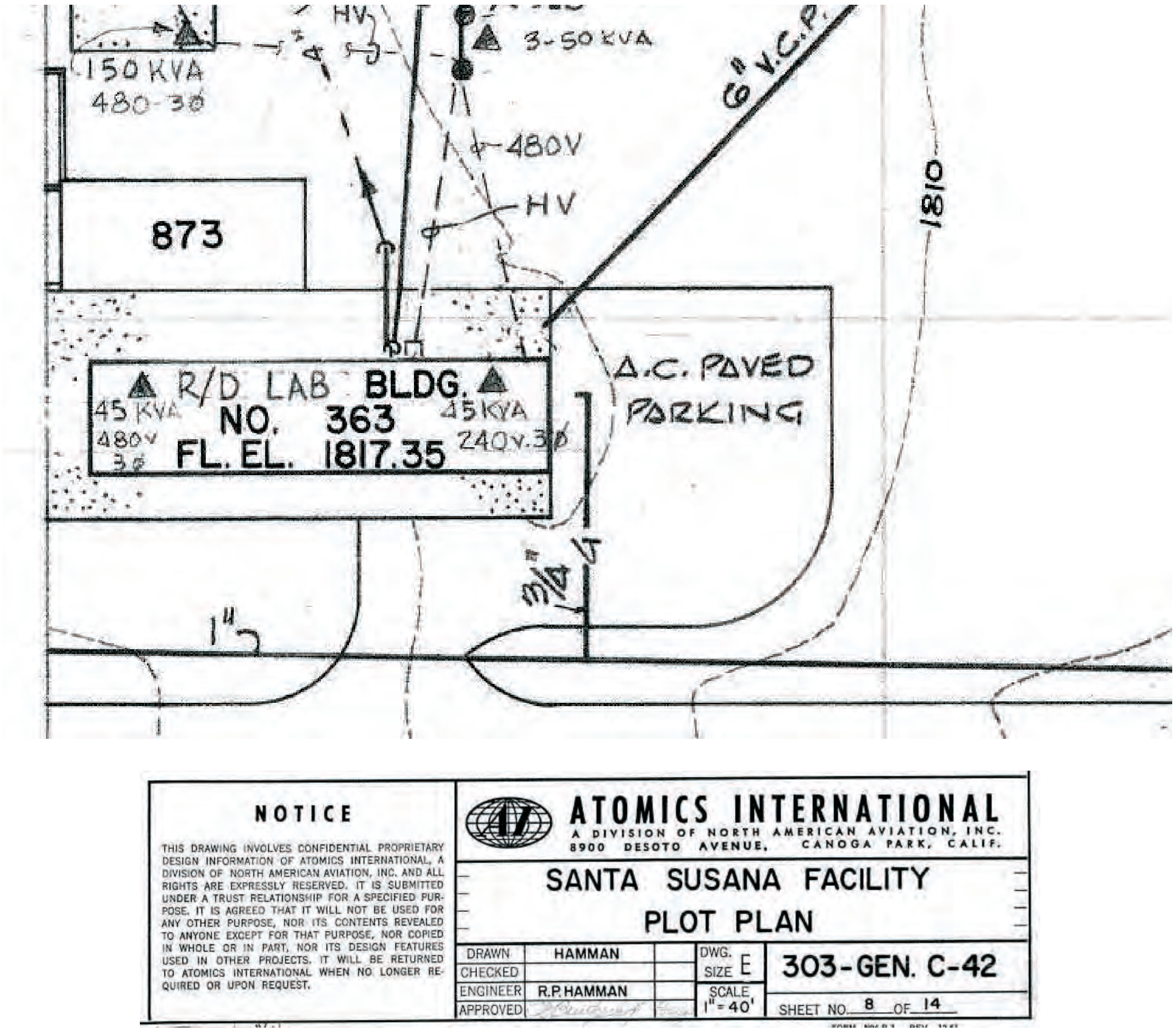
Figure 2.3.10b
Building 4863
Facility Photographs

Y:/Santa_Susana/EP9038/TM/HSA_5D
(2-3-11a)Bldg4873SP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.11a
Building 4873
Site Photograph

Redacted



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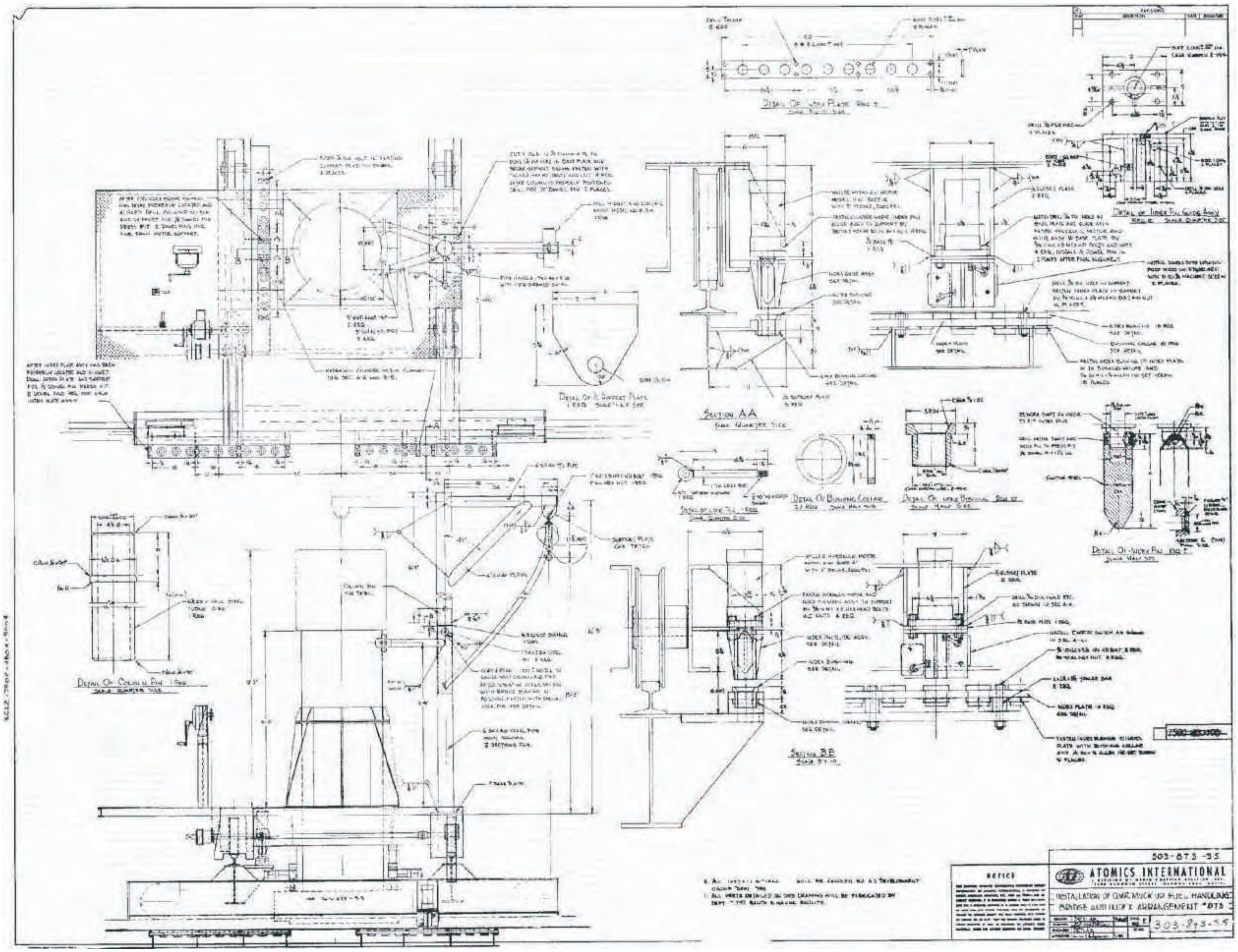
(2-3-11b)Bldg4873PP.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.11b
Building 4873
Plot Plan

Redacted



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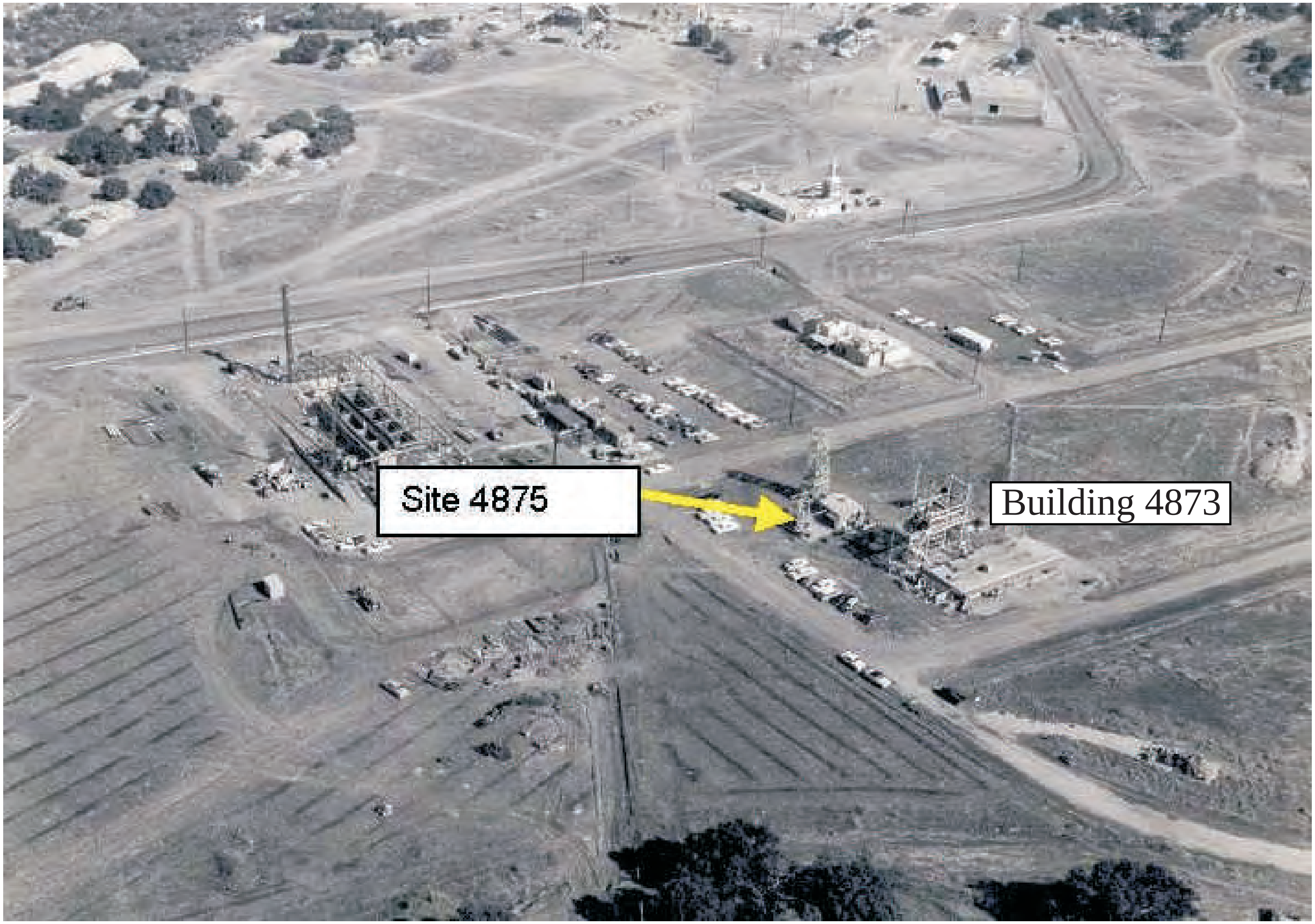
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.11c
Building 4873
OMR Mock-Up Fuel
Handling Bridge

Redacted



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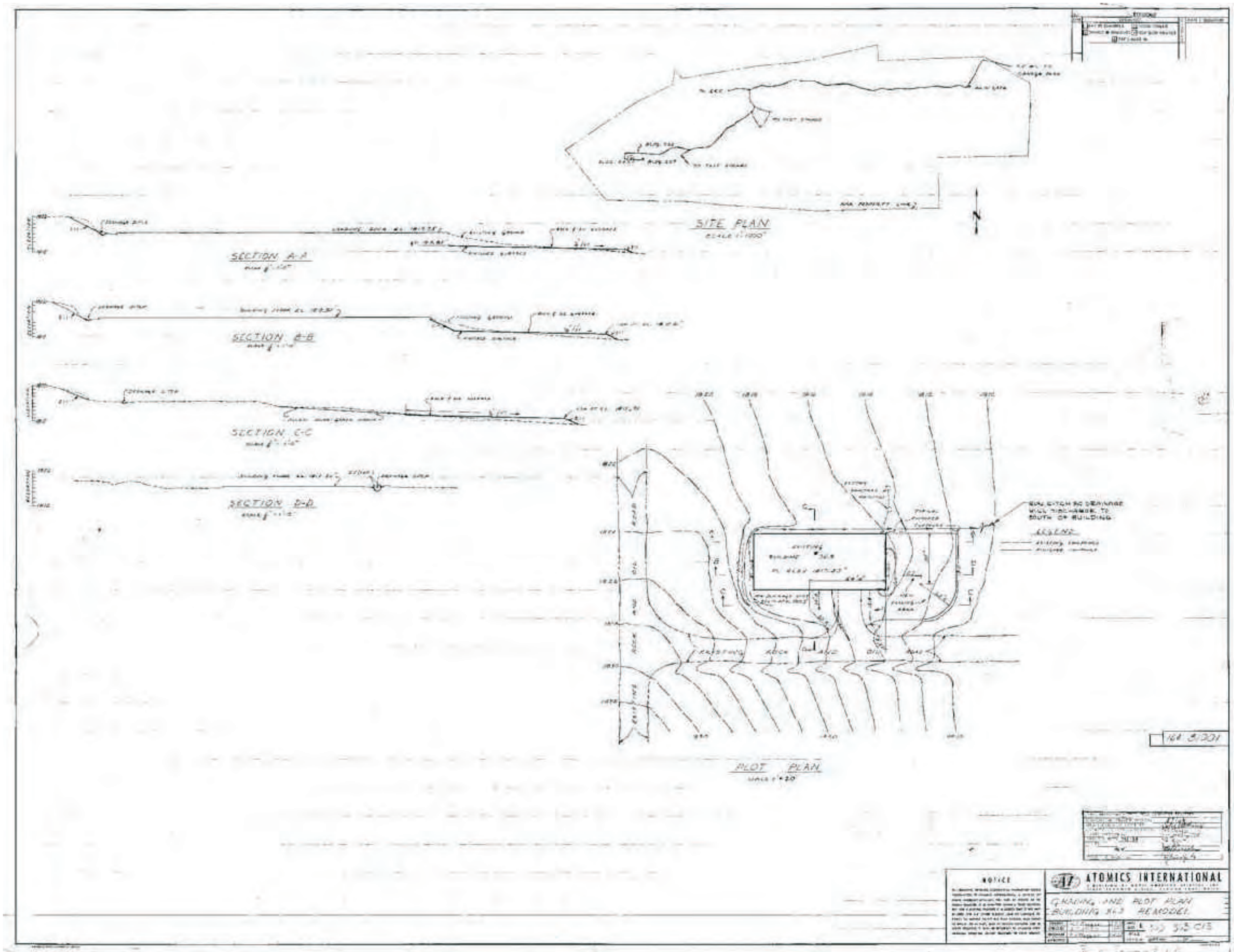
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.11d
Building 4873 Aerial Oblique Photograph 1958



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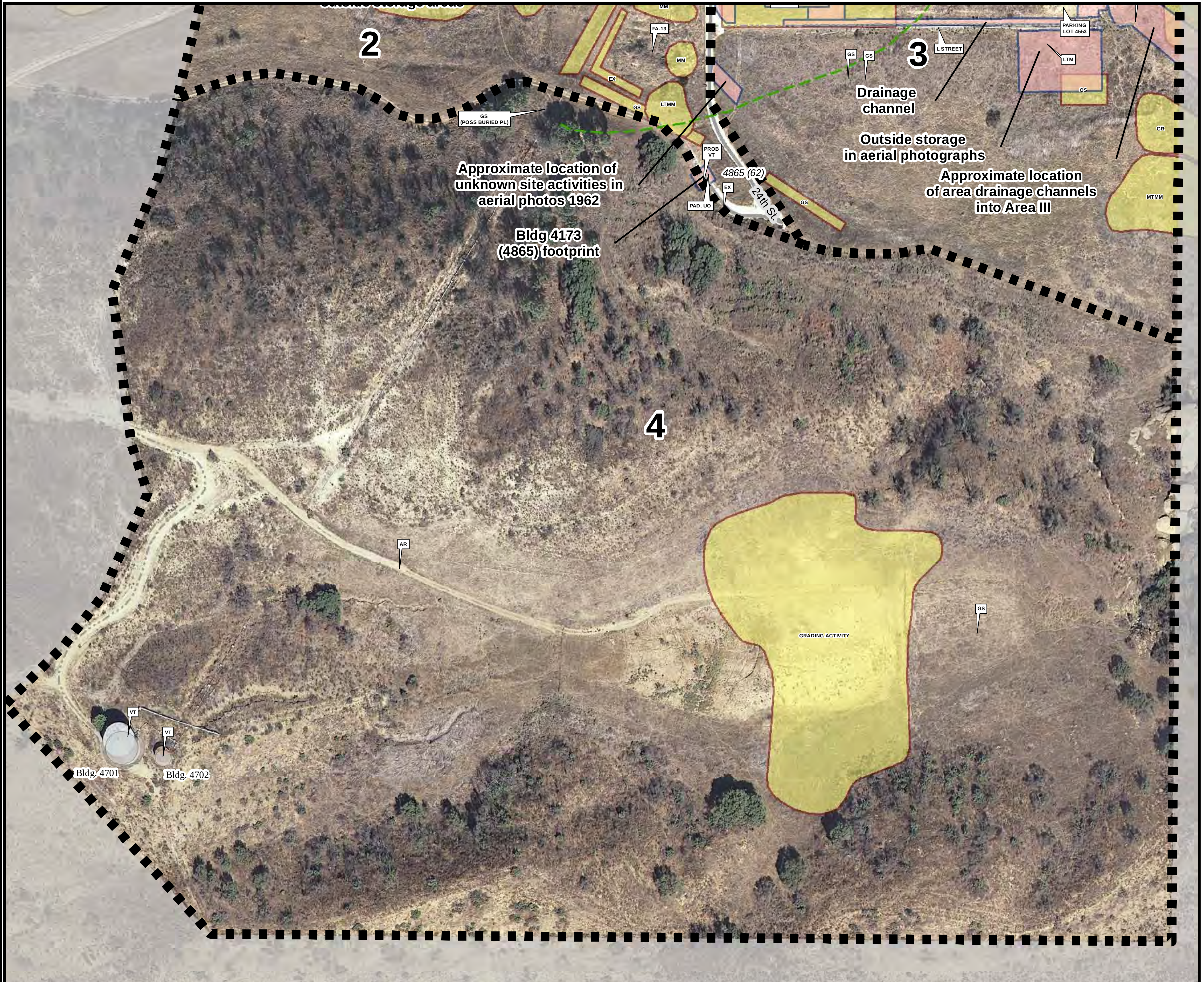
(2-3-11e)Bldg4873DR.cdr
Project:EP9038
Revised: 03/23/2011 TJ
Source: Boeing Company, 2008

U.S. EPA Region 9

Figure 2.3.11e
Building 4873/4363
Drainage

Redacted

Figure 2.4
Area IV Subarea 5D-4
Santa Susana Field Laboratory



U.S. EPA Region 9

Legend

- Subarea 5D-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
- Proposed Sampling Locations
- 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

0 25 50 100
Scale In Feet

Y:\Santa_Susana\EP9038\TM\HSA_5D\(2-4)5D-4.mxd
12/1/2011 tjansen
Sorce: Boeing Company, 2008
CIRGIS, 2007

HGL HydroGeoLogic, Inc

Redacted

REPORTED INCIDENTS
NOT RESULTING IN ENVIRONMENTAL RELEASE

BUILDING 4020

- On August 26, 1959, a personnel injury occurred at Building 4020. During routine entry into Cell #3, an employee was struck across the hands by a heavy steel ramp that dropped suddenly when the cell door opened. At the time of the injury, the employee was holding a Juno survey meter in each hand to monitor the radiation levels at the doorway. The employee was assisted to the hot change room and all protective clothing was removed. The employee was surveyed and no significant contamination was detected. The employee was taken to the plant hospital at Rocketdyne in Canoga Park. Hospital smears near the wounds also found no significant contamination. The incident report does not indicate what constitutes a significant amount of contamination (Incident Report A0002).[1]

- On April 16, 1960, two employees entered Decontamination Room (Decon) #4 to perform decontamination of the cut-off saw assembly, which has been used to cut irradiated sodium reactor experiment (SRE) fuel slugs. These employees were in violation of the 300 millirem (mrem) exposure limits for one week (Incident Report A0392).[2]

- On April 18, 1960, an employee in Decon #3 called another employee over to the area and asked if he felt brave, then placed an unknown object in his hand. The employee holding the small cylindrical object approximately 2.5 inches long and 0.75 inches in diameter quickly saw that the object was stamped E-2, indicating a batch of SRE fuel slugs. The employee immediately tossed the SRE slug into the airlock. The slug was picked up with 6-foot tongs and placed in a can filled with lead shot. The slug measured 25 R/hr at 10 inches and 25 RAD/hr at 21 inches (Roentgens per hour is generally defined as R/hr and rads per hour is generally defined as rad/hr; units may be incorrectly presented in the source document). Another employee took the can containing the slug into Decon #4. By this time, the employees in the service gallery and connected to the operation were going to the hot change room to change out of contaminated clothing and go to lunch. The incident was reported to the health physics department (Incident Report A0003).[3]

- On May 12, 1961, a lead shipping cask containing 9,500 Curies (Ci) of fission products was placed on a flat rail car for transport into the airlock when it was observed that the rails to the moveable dock had not been secured to either the dock or floor of the airlock. Operating personnel were requested to hold up the operation until the rails were aligned and bolted down, but the car was already moving and it ran off the rails and tilted to one

---

[1] Bold, F.O. Atomics International Internal Letter, *Re: Personnel Injury at CDHC Building 20, Santa Susana*, September 29, 1959.
[2] Health Physics, Atomics International, *Notice of Radiological or Industrial Safety Rule Infraction*, April 22, 1960.
[3] Clow, H.E., Atomics International Internal letter, *Re: Radiological Safety Incident Report, Cell #3 CDHC Bldg. #20, 4/18/60*, June1, 1960.

side. A corner of the car caught the edge of the dock and stopped leaving the cask at a 15 degree angle. A fork lift was brought in to remove the cask from the car and place it on the ground. No radiological exposure resulted from the incident (Incident Report A0011).[1]

- On May 21, 1961, two employees were transferring radioactive waste in Building 4020 when a dust was observed being generated from the transfer operation. The operation was discontinued and the men were taken to the change room for monitoring. One employee was found to have approximately 1,500 counts per minute (cpm) of beta-gamma contamination on his forehead. The other employee had approximately 1,100 cpm beta-gamma contamination on his pants. One employee had a nasal smear of 850 cpm beta-gamma contamination. A health and safety representative noted that the men were only wearing lab coats and shoe covers, not the appropriate protective clothing for operations (Incident Reports A0347 and A0505).[2,3]

- On June 2, 1961, an employee doing routine work in Decon #3 pinched a flexible supplied air hose to his supplied air mask causing the hose to explode. The employee immediately stopped breathing and moved to the clean door where he removed his mask, put on an assault mask and waited for an additional supplied air mask and hose. A nasal smear indicated no significant contamination of mixed fission products (Incident Report A0283).[4]

- On June 19, 1961, personnel entered Decon #2 prior to entering Cell #2 to repair a balance in the cell. The door to Cell #2 was being opened when a front side operator controlling the door opening noticed two Systems for Nuclear Auxiliary Power (SNAP) Experimental Reactor (SER) fuel elements lying on the floor and ordered the door closed. An unknown radiation field from the two SER fuel elements was estimated at approximately 1,500 rads/hr at 1 foot. No first air or health physics sampling was required for the employees entering the cell. The incident report called for a more thorough examination of cells prior to entering and recommended a remote area monitoring system to monitor cells before actually entering them (Incident Report A0012).[5]

- On September 4, 1962, the repair of a copper inlet line between the fission gas sampling apparatus and Cell #3 caused high airborne activity, resulting in the contamination of personnel and the lab. A routine radiation survey taken on August 31, 1962 revealed

[1] Badger, F.N., Atomics International Internal Letter, *Re: Radiological Safety Incident Report, CDHC Bldg. 020, May 12, 1961*. May 15, 1961.
[2] Yarrow, A.R., Atomics International Internal Letter, *Re: Radiological Safety Incident Report, Building Number 20, 5-20-1961*, May 26, 1961. (Corrects incident date from May 20, 1961 to May 21, 1961)
[3] Yarrow, A.R., Atomics International Internal Letter, *Re: Radiological Safety Incident Report, Building Number 20, 5-20-1961*, May 26, 1961. (It is unclear why this incident has two different reports and report numbers associated with it.)
[4] Badger, F.H., Atomics International Internal Letter *Re: Radiological Safety Incident Report, CDHC Decontamination Cell #3, June 2, 1961*. June 15, 1961.
[5] Clow, H.E., Atomics International Internal Letter, *Re: Radiological Safety Incident Report, DeCon #2 & Cell #2 at CDHC, 6-19-1961*. June 21, 1961.

excessive contamination building up inside the copper line. Radiation levels reached a maximum of 1.5 r/hr (units may be incorrectly presented in the source document). The copper line was removed and placed in a plastic bag and a new line was installed. Health and Safety was called to smear the area. During this operation, the Health and Safety representative found his hands and shoes contaminated and an air monitor recorded an increase in airborne activity from 250 curies per meter (Ci/m) to 1000 Ci/m.

Personnel were evacuated from the operating gallery and an air sample was taken with a portable sampler. Airborne activity was found to be 5.4 x 10-10 µC/cc beta-gamma. A smear survey revealed floor contamination averaging 10,000 dpm /100 cm^2, with a maximum of 130,000 dpm /100 cm^2 beta-gamma. Smears of desks, benches, and other horizontal surfaces revealed removable contamination of 15,000 dpm/cm2 beta-gamma. The floors of the office areas, rest rooms, and mock-up shop were found contaminated to a maximum level of 1,000 dpm/100 cm^2 beta-gamma, presumably as a result of tracking from the operating gallery.

Smears of the removed copper tube and its plastic bag showed contamination of 140,000 dpm/100 cm^2 beta-gamma inside the bag, 20,000 dpm /100 cm^2 beta-gamma on the tube surface, and 2,000 dpm/100 cm^2 beta-gamma on the exterior bag surface. Radiation levels of 25 rad/hr were found at the open end of the copper tube. The copper tube contained sufficient contamination to cause the levels found on the floor and other surfaces, but it was considered an unlikely source for such widespread contamination. It was also hypothesized that at the time the copper tube was being removed Cell #3 was being purged leading to contamination of the operating gallery. Operations at all cells were suspended until the complete area was decontamination to "permissible levels." The incident report does not define "permissible levels" (Incident Report A0018).[1]

- On December 15, 1962, a worker found contamination on his shoes during a visit to Building 4020. The surface dose rate on the worker's shoes was 20 m rad/hr and the activity on a smear sample was 10^5 dpm/100 cm^2 beta-gamma. Floor smear surveys were conducted in areas visited by the worker. Beta-gamma measurements were found as follows: Health and Safety Office (100 dpm/100 cm^2); Engineering Office (200 dpm/100 cm^2); Supervisors Office (90 dpm /100 cm^2); Operating Gallery (~30 to 400 dpm /100 cm^2); Cold Change Room (2,000 dpm /100 cm^2); Men's Restroom (200 dpm/100 cm^2); and hallways connecting these locations (~200 dpm /100 cm^2). Smears taken from the shoes of other personnel were found to have contamination ranging from 30 dpm/100 cm^2 to 1,200 dpm /100 cm^2. It was not clear where the contamination originated. The entire building was monitored with a portable survey meter and no contamination levels as high as 20 mrad/hr were found (Incident Report A0020).[2]

- On January 25, 1963, an employee was monitoring Cell #3 and tore open his right glove with a pair of cutters. The employee found his hand and shoes contaminated. After an

[1] Hanseon, W.D., Atomics International Internal Letter, *Re: Contamination Incident at the CDHC*, October 26, 1962.
[2] Bergstrom, W.H., Atomics International Internal Letter, *Re: Incident Report CDHC*, January 17, 1963.

hour and a half of repeated scrubbing in the "hot shower" with scouring powder and permanganate treatment the contamination was eliminated. The employee's shoes could not be decontaminated and read 10 mrad/hr beta-gamma when disposed (Incident Report A0021).[1]

- On May 8, 1963, two janitors waxing the mock-up area floor dragged a mop through a highly contaminated trough by the side door of Cell #4 and then used the mop to wax the remainder of the floor, spreading mixed fission product contamination throughout the mock-up area. Upon departing the area, the janitors checked themselves in the hand and foot counter and found that their shoes were contaminated to as high as 1 mrad/hr beta-gamma. A hot spot of 5 mrad/hr beta-gamma was identified on the mock-up room floor near the side door of Cell #4. A smear survey of the floor revealed contamination ranging from less than 30 dpm/100 cm^2 to 90,000 dpm/100 cm^2 beta-gamma. The floor wax appeared to have semi-fixed the contamination. Personnel were notified and the mock-up area was roped off and tagged. Measurement taken two days later indicated that the floor contamination had dissipated and the area could be reclassified as non-tagged (Incident Report A0433).[2]

- On September 26, 1963, a fire occurred in the doorway between Decon #3 and Cell #3 during the cleaning of the fission gas rig with butyl alcohol. The fire was apparently caused by residue of NaK in the fission gas rig that reacted with the alcohol. The fire lasted 2 minutes and was extinguished with calcium carbonate. No injuries occurred and no increases in airborne contamination were found (Incident Report A0024).[3]

- On September 26, 1963, an employee emerged from Cell #3 after conducting cell cleanup and found his dosimeter was off scale. The contamination was thought to have been the result of contact with a drip pan in the cell. A survey of the pan showed a dose rate of 3 rad/hr at surface and 25 rad/hr at 1 ft. The employee's film badge showed an uncorrected dose of 295 mrem (Incident Report A0025).[4]

- On October 9, 1963, it was discovered that a fire occurred in Cell #2 during the night. Investigation found the furnace in Cell #2 had been left on without any controlling thermocouples. The temperature of the furnace could have reached 2,300 degrees Fahrenheit. Approximately 100 ft^2 of blotter paper, which is used as a floor covering in the cell, was burned. A check of the stack monitor and the operating gallery showed no increase above normal activity for the preceding 24 hour period. Spot smears of the floor, cell face, and equipment in the operating gallery were all 30 dpm/100 cm^2. The incident report notes this is the third fire in the last three weeks at Building 4020 and

[1] Bergstrom, W.H., Atomics International Internal Letter, *Re: Contamination Incident at CDHC*, February 12, 1963.
[2] Lane, W.B., Atomics International Internal Letter, *Re: Radiological Safety Incident Report, Mock Up, CDHC, Room 125, May 8, 1963.* May 13, 1963.
[3] Lane, W.D. and D. Tworek, Atomics International Internal Letter, *Re: Radiological Safety Incident Report, CDHC, 9/26/63*. Undated.
[4] Tworek, D. and W. Lane, Atomics International Internal Letter, *Re: Radiological Safety Incident Report, Building 020 CDHC, 9/26/63*. Undated.

suggests the lead man should make a thorough check of all equipment before leaving the facility (Incident Report A0026).[1]

- On March 20, 1964, the door of Cell #4 was opened at the same time a nitrogen purge and "UC" (presumably uranium carbide) fuel cutting occurred in Cell #3, resulting in increased airborne beta-gamma activity. The maximum airborne concentration was 5 x 10^{-9} µCi/cc with no smearable detectable contamination above limits. The incident report does not note what the contamination limits were (Incident Report A0031).[2]

- On June 8, 1964, an employee repairing in-cell hacksaws without authorization and proper protection was contaminated. The hacksaws had a maximum of 2.5 rad/hr mixed fission product contamination. Smearable contamination on tools was as high as 2 x 10^{5} dpm/100 cm^2 beta-gamma. The employee was surveyed and decontaminated in the hot shower (Incident Report A0551).[3]

- On June 16, 1964, a Piqua fuel element in Cell # 3 was repositioned in the cell such that the element was in line with the cell manipulator port opening and north operating gallery probe. Because there is no shielding at the port opening, excessive radiation streamed through the port. A radiation survey found contamination levels at the port opening to be 1,000 mr/hr (units may be incorrectly presented in the source document). All future operations involving the movement of high level radiation sources were to be scrutinized to prevent a recurrence of this type of incident (Incident Report A0443).[4]

- On July 10, 1964, the health physics department observed that the Decon #3 doors, the service gallery doors, and the airlock outer doors were all in the open position during loading of a cask into the airlock. This situation allows for a potential spread of contamination to clean areas. A smear survey of the outside area failed to detect any contamination. The incident report notes that this problem had occurred during similar operations in the past and is mostly due to negligence. A modification of the airlock door latching devices was expected to minimize recurrence (Incident Report A0338).[5]

- On July 23, 1964, an employee cleaning Cell #4 inadvertently contacted wet spots on the false flooring where mixed fission products up to 25 rad/hr contaminated his knees to a maximum of 0.3 mrad/hr and 270 dpm/100 cm^2 beta-gamma. Loose contamination was removed and the employee was released to the medical department for further treatment.

[1] Tworek, D.D and W. Lane, Atomics International Internal Letter, *Re: Radiological Safety Incident Report, CDHC Cell #2, 10/8/63-10/9/63*. October 17, 1963.
[2] Ericson, G.I. and W. Lane, Atomics International Internal Letter, *Re: Increased Airborne Activity at Building 020*. April 2, 1964.
[3] Ericson, G. and W. Lane, Atomics International Internal Letter, *Re: Incident Report, Yellow Tag Manipulator Repair Room, Bldg. 20, June 8, 1964*. June 11, 1964.
[4] Ericson G. and W. lane, Atomics International Internal Letter, *Re: Incident Report, CDHC Cell #3 and Operating Gallery, 6-16-64*. June 24, 1964.
[5] Ericson, G. I., Atomics International Internal Letter, *Re: Incident Report, CDHC Airlock Service Gallery and Decon #3, 7-10-64*. July 20, 1964.

Recommendations include wearing knee pads during cleanup and using clean plastic sheeting on the floor where personnel are working (Incident Report A0554).[1]

- On August 27, 1964, an alarm in the operating gallery went off when the air activity increased to 2.5 x 10^{3} cpm with normal background levels at 500 cpm. The operating gallery was evacuated. Ten minutes air samples showed air activity gradually decreasing from 3.8 x 10^{-9} µCi/cc to 3.6 x 10^{-10} µCi/cc. The release was attributed to loss of an airborne controller in Cell #3 used during purging of the cell. The controller was replaced (Incident Report A0354).[2]

- On September 3, 1964, an employee surveyed his work area in Cell #1 and found a vacuum cleaner hose was reading 25 rad/hr gamma. A front side man moved the vacuum cleaner to a far corner of the cell and the in-cell man began work. The in-cell employee later discovered that the polishing cloth he was using read 25 rad/hr gamma and the vacuum cleaner was only 10 rad/hr. The employee had failed to resurvey the work area after the vacuum cleaner was moved. The employee received 270 mrem on his dosimeter and a corrected dose of 1,145 mrem on his film badges. His ear was contaminated to 0.2 mrad/hr and less than 30 dpm /100 cm^2 of removable contamination (Incident Report A0415).[3]

- On October 15, 1964, an employee acting as the cold man on a Cell #3 entry removed his mask in the service gallery while bagging shielding blankets. Investigation found that a blanket was contaminated to 5 mrad/hr beta-gamma. A smear survey indicated maximum contamination levels of 2.7 x 10^{5} dpm/100 cm^2 beta-gamma in the immediate area. The employee contaminated his leg to a maximum of 0.5 mrad/hr and a nasal swipe found 600 dpm/100 cm^2 beta-gamma. A new method of bagging the shielding blankets was put in effect as a result (Incident Report A0337).[4]

- On November 18, 1964, an employee working in Cell #3 found particulate contamination on his head when he conducted an exit survey. Investigation revealed a maximum of 100 mrad/hr contamination and less than 30 dpm /100 cm^2 beta-gamma. After five attempts, the particulate contamination was washed off the employee's head and he was found to be free of contamination (Incident Report A0574).[5]

- On December 7, 1964, an inspection of the radioactive holdup yard at Building 4020 revealed the storage of numerous unidentifiable barrels, boxes, shipping containers, and pigs in various states of disarray. Some of the items have been in state for more than 2

[1] Ericson, G.I. and W. Lane, Atomics International Internal Letter, *Re: Incident Report, CDHC Cell #4, 7-23-64.* July 28, 1964.
[2] Lane, W.D., Atomics International Internal Letter, *Re: Incident Report, Building 020, Operating Gallery, CDHC, 8-27-64*. September 22, 1964.
[3] Lane, W.D., Atomics International Internal Letter, *Re: Incident Report, Cell #1CDHC, 9-3-64*. October 5, 1964.
[4] Ericson, G.I., Atomics International Internal Letter, *Re: Incident Report, CDHC Service Gallery, 10-15-64.* October 20, 1964.
[5] Ericson, G.I., Atomics International Internal Letter, *Re: Incident Report, CDHC Cell #3, 11-18-64*. December 17, 1964.

years. A radiation survey indicated a maximum of 50 mR/hr gamma at the outer perimeter of the holdup yard, a violation of 10 C.F.R. 20.105 and 20.203 (Incident Report A0034).[1]

- On July 16, 1965, it was discovered that a fuel wafer had disintegrated on a vacuum filter and caused buildup of 2.2 Ci of mixed fission products. In Cell #2 an in-cell vacuum distillation cold trap was measured at 100 R/hr and the lines extending to the cell face were measured at 25 R/hr. A filter was removed from the cell and bagged, but a release occurred between the time the filter was removed and when it was bagged. Contamination had been transported through the operating gallery, cold change room, and into the service gallery. When the extent of contamination was discovered, movement was restricted and the facility underwent cleanup. No radioactive material was released outside the building (Incident Report A0037).[2,3]

- On September 21, 1965, the constant air monitor located at the north end of the operating gallery triggered the lower alarm (~1,000 cpm). Operations personnel were decladding SNAP 8 Experimental Reactor (S8ER) fuel in Cell #3 and were purging the cell with nitrogen. All systems and possible sources were checked, but no abnormal conditions were noted. A 10 minute air sample indicated 2.5 x 10^{-8} µCi/cc beta-gamma immediate count. The constant air monitor was still climbing and indicated 7,000 cpm. Further checks of equipment were made and spot smears were taken throughout the area. Smears were normal and no problems were noted. A call to other buildings and a check of other areas of Building 4020 indicated the problem was localized. A second air sample indicated 4.2 x 10^{-8} µCi/cc beta-gamma. The constant air monitor was leveling off at 9,000 cpm. A third air sample indicated 4 x 10^{-10} µCi/cc beta-gamma. The incident report notes that no radioactive material was released to the environment and no increase in surface contamination was found. There was no apparent cause for the increase, although it was generally believed to have come from Cell #3 (Incident Report A0038).[4]

- On February 2, 1966, two employees inadvertently exposed one hand each to the radiation field from a mounted irradiated S8ER fuel metallographic sample. The estimated doses to the hands were 58,000 mrem and 2,000 mrem for the two men involved. A fixture was being transferred remotely into Cell #1 by way of the metallograph tunnel. The fixture jammed in the tunnel and an S8ER fuel sample fell off the transfer train. An employee impulsively picked up the fuel sample and placed it back in the train bucket. Realizing what he had done, the employee immediately called the health physics department. Another employee was also present and received a lesser

[1] Ericson, G.I., Atomics International Internal letter, Re*: Radioactive Materials Holdup Yard at CDHC Building 020*. December 7, 1964.
[2] Author Name Redacted, Atomics International Internal Letter, *Re: Contamination Spread on Friday, July 16, 1965*. July 28, 1965.
[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. AA-3.
[4] Badger, F.H., Atomics International Internal Letter, *Re: Excessive Concentration of Airborne Radioactive Material*. September 28, 1965.

exposure. A recreation of the incident was used to determine exposure time and estimated dose (Incident Report A0039).[1]

- On February 24, 1966, three men who had been working in the service gallery, Decon #3, and Cell #3 were found to have nasal contamination ranging from 450 dpm to 4,500 dpm beta-gamma and slight skin contamination. Contaminated fine powders generated during operation of an electronic discharge machine (Elox machine) settled in and around the screw holes of the machine. When one of the employees removed the screws to replace an electric motor, the powder circulated into the air. The employee replacing the motor received the greatest contamination. Another employee in the vicinity who was not wearing respiratory protection and received the second highest level of contamination. A third person removed his mask in an area of high floor contamination and received the least amount of contamination. The men were decontaminated.

  A spot smear of the service gallery showed floor contamination outside Decon #3 of ~75,000 dpm beta-gamma with several areas in the direction of the change room reading ~12,000 dpm beta-gamma, indicating the spread of contamination as the men left the area. It was recommended that a low purge be on during decontamination and cleaning operations (Incident Report A0040).[2]

- On August 16, 1966, an electrical power failure occurred in Building 4020 and the emergency generator for equipment such as the radioactive exhaust failed to engage. Emergency power was established 15 minutes later. The constant air monitor in the operating gallery showed an increase from 2,000 cpm to 5,000 cpm. A high volume air sample was taken after power was reestablished and indicated an airborne concentration of 3×10^{-8} µCi/cc beta-gamma. Smear samples indicated less than 30 dpm/100 cm^2 and additional air samples indicated a maximum of 5×10^{-9} µCi/cc beta-gamma. A second high volume air sample taken approximately 45 minutes after the power failure and showed 4×10^{-10} µCi/cc beta-gamma. At this time the area was released. According to the incident report, no injuries, loss of equipment, or significant release of radioactive materials occurred as a result of the power failure (Incident Report A0042).[3]

- For the week ending December 31, 1966, personnel involved in the promethium-147 (Pm-147) heat source fabrication were found to have extremity overexposures in excess of quarterly limits as indicated by finger ring film dosimeters. However, reevaluation of the film dosimeters indicated no legal overexposure had occurred. It was known that extremity exposure would be a controlling factor in the radiologically safe fabrication of Pm-147 heat sources. Numerous problems in the fabrication operations extended the estimated time of completion from 5 days to 20 days. Project schedules and budgets were extremely tight and investigation of the incident disclosed that some procedural

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[1] Badger, F.H., Atomics International Internal Letter, *Re: Accidental Excessive Exposure*. February 8, 1966.
[2] Mooers, A.R., Atomics International Internal Letter, *Re: Personnel Contamination Incident – February 24, 1966 A.I.H.L.* March 16, 1966.
[3] Badger, F.H. Atomics International Internal Letter, *Re: Power Failure at Bldg. 020, Santa Susana*. August 29, 1966.

violations occurred in an effort to accomplish the job on schedule at a minimum cost. Examples of problems encountered include: a powder volume 30 percent greater than anticipated, which required three pressings per pellet instead of two pressings; breaking or cracking of pellets; a broken fuel hopper that spilled 5,000 Ci of fuel on the floor; and unsuccessful welding of capsules. These problems and more led to increased dose rates for operators (Incident Report A0044).[1]

- On January 28, 1967, an employee in the Slave Shop contaminated his coveralls by leaning across a piece of equipment. Unaware of the contamination he brushed his gloves over the coveralls, flaking the contamination onto his shoe covers. The employee then walked about the Service Gallery and Hot Shop spreading the contamination. Contamination ranged from 10^5 to 4×10^5 dpm/100 cm^2 beta-gamma, but was brought down to less than 500 dpm/100 cm^2 beta-gamma in a single cleaning with a scrubber and vacuum. No contamination was tracked outside of a controlled area (Incident Report A0607).[2]

- On April 6, 1967, a fire occurred in Cell #3 during the cutting of a uranium fuel sample. Hot sparks ignited the cut-off wheel coolant (isopropyl alcohol), which in turn ignited three absorbent pads. The fire was extinguished using a low volume nitrogen purge. No significant release of radiological material was detected (Incident Report A0613).[3]

- On May 17, 1967, a Pm-147 release occurred during transfer of wet Kimwipes into glove box B through the air lock. Maximum airborne contamination levels of 2×10^{-9} µCi/cc were detected by air samplers located at the glove box face. The radiation concentration guide is 1×10^{-7} µCi/cc. Nasal swabs of the two men working in the area revealed a maximum 1,050 dpm/100 cm^2 (Incident Report A0617).[4]

- On June 10, 1967, approximately 55 gallons of Pm-147 waste were removed from glove boxes A and B in Building 4020. During the procedure, which involved bagging-out the waste through the airlock, an air monitor detected high airborne activity immediately following the cutting of a bag for separation from the glove box. Filters from the air samplers indicated activity of 8×10^{-8} µCi/cc when average over 8 hours. The air concentration standard is 1×10^{-7} µCi/cc for 40 hours. No personnel were affected because they were all wearing supplied air at the time of release. The area was decontaminated prior to proceeding with the operation (Incident Report A0619).[5]

[1] Badger, F.H. and F.C. Schrag, Atomics International Internal Letter, *Re: Extremity Exposure Associated with Primary Encapsulation of Pm-147*. February 3, 1967.
[2] Alexander, R.E., Atomics International Internal Letter, *Re: Radiation Safety Weekly Newsletter for Period Ending January 28, 1967*. January 31, 1967.
[3] Alexander, R.E. Atomics International Internal Letter, *Re: Radiation Safety Unit Weekly Newsletter for Period Ending April 8, 1967*. April 13, 1967.
[4] Alexander, R.E., Atomics International Internal Letter, *Re: Radiation Safety Unit Weekly Newsletter for Period Ending May 20, 1967*. May 24, 1967.
[5] Alexander, R.E., Atomics International Internal Letter, *Re: Radiation Safety Unit Weekly Newsletter for Week Ending June 10, 1967*. June 15, 1967.

- On October 11, 1967, an employee received an internal exposure from Pm-147 while working on glove box A in the hot shop. After transferring waste from glove box A to glove box B and cleaning glove box A, two employees followed normal procedures for leaving the area and monitoring themselves. One employee found no contamination on himself, while the other employee found a spot between his nose and lip that was contaminated to ~1,000 cpm. He removed the contamination. After showering, the employee went to the health physics office and was resurveyed. When he opened his mouth the count rate increased from 50 cpm (normal background) to 150 cpm. A smear sample taken from his mouth revealed contamination of 550 dpm. His mouth was rinsed of water until free of detectable contamination. Surface contamination of the top of glove box A was found to be as high as 4.3 x 10^5 dpm/100 cm^2. Both gloves on the left window were contaminated to 1.7 x 10^5 dpm/100 cm^2. Other smears samples and air samples in the area indicated contamination levels of less than 5,000 dpm /100 cm^2. The contamination was suspected to have been transferred to the top surface of glove box A by a contaminated cover plate from the left glove. The employee working at glove box A then ingested the contamination through licking of his lips (Incident Report A0047).[1]

- On July 22, 1970, a small alcohol fire occurred in Cell #3 during the disassembly of a NaK-bonded SNAP 8 Development Reactor (S8DR) fuel element. The fire started when an end cap of the fuel element was placed in a pan of alcohol to dissolve NaK accumulation from the cap. The fire was immediately suppressed by placing a lid on the pan. No damage resulted from the fire and there was no evidence of airborne or surface contamination (Incident Report A0050).[2]

- On October 11, 1970, an alarm activated on the constant air monitor located in the operating gallery of Building 4020. Pressure gauges were reading normal. The scale on the air monitor was switched, but the monitor did not respond immediately so it was assumed to be malfunctioning. Further investigation showed the air monitor to be working properly. A high volume air sample was taken in the vicinity of the constant air monitor and showed 5 x 10^{-10} µCi/cc beta. An identical high volume air sample was taken outside Building 4020 and produced the same result. A smear survey from the floors and equipment tops located in the operating gallery showed less than 30 dpm / 100 cm^2. No problem was found in the building. It was noted that the natural airborne concentrations on October 11, 1970 were approximately five times higher than those observed in the previous two years and after 24 hours the air sample results were back to background activity levels (Incident Report A0051).[3]

- On September 30, 1977, in preparation for removal of old radioactive liquid waste tanks from the basement of Building 4020, employees cut into a pipes and failed to cap them, causing an unexpected drop in air pressure. A spot smear survey was taken and

[1] Lane, W.D., Atomics International Internal Letter, *Re: Pm-147 Internal Exposure Incident of October 11, 1967*. November 6, 1967.
[2] Klostermann, J.P., North American Rockwell Internal Letter, *Re: Small Alcohol Fire in AIHL Cell #3*. July 27, 1970.
[3] Klostermann, J.P., North American Rockwell Internal Letter, *Re: Investigation of CAM Alarm – Bldg. T020*. October 13, 1970.

compared to a spot survey taken September 26, 1977. The average of the smear area was 250 dpm/100 cm^2 beta-gamma on September 26. The average smear on September 30 was 1,380 dpm/100 cm^2. No increase in airborne activity was detected (Incident Report A0060).[1]

- On April 25, 1978, while attempting to change one of the 3-quart collection cans on the evaporator that contained caustic solution from the sodium digester, an employee dropped the collection can spilling radioactive solution over one fifth of his body. The employee was instructed to use the radiologically controlled drainage shower. Maximum activity detected in a quick survey was 30,000 cpm (12 mrad/hr) on the employee's right forearm. A 15 minute shower produced 100 gallons of radioactive liquid. After the shower, 500 cpm contamination remained on the employee's right knee and forearm. A bactine scrub removed contamination on the forearm, but immediate efforts to decontaminate the knee were unsuccessful and would have to be continued in the medical department. Dressings applied to sore spots were removed by the company doctor and returned to Building 4020 for disposal (Incident Report A0067).[2]

- On May 3, 1978, the alcohol evaporator in Decon #2 caught on fire, burning most of the insulation off the electrical wires before it was extinguished by a nitrogen purge. No personal injury, exposure, or facility damage resulted. The evaporator has been routinely filled with alcohol from the sodium digester in the morning. The evaporator was turned on and about 1.5 hours later a fire was observed. The fire was extinguished within 5 minutes. Inspection the following morning, indicated an electrical fire, but no cause for an electrical short was found. The incident report notes that the evaporator is being redesigned with an emphasis on heavier insulation and simpler loading (Incident Report A0069).[3]

- On February 9, 1979, alcohol from the Hallam fuel bonding sodium digester system spilled after the salt preparation and before distribution. Approximately 1 to 2 gallons containing mixed fission products spilled. The personnel involved required no first aid and nasal smears were at background levels (Incident Report A0076).[4]

- On August 21, 1981, personnel were loading bags of equipment contaminated with mixed fission product from the hot storage room into a box in the airlock. Routine personnel survey after removing protective clothing indicated nasal, facial, and hair contamination up to 4,400 dpm per nasal swipe. Personnel were decontaminated. Investigation indicated two possible sources of the contamination. One bag was cut open to remove lead bricks and facilitate lifting with a fork truck. The second possible source was a bag containing a furnace that broke open on a 5 rad/hr source. Smears of the hot storage room measured up to 200,000 dpm /100 cm^2 beta-gamma and smears of the airlock measured up to 57,000 dpm /100 cm^2 beta-gamma. Personnel were familiar with good

[1] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Occurrence – Bldg. T020*. October 3, 1977.
[2] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Occurrence – Decon 2*. April 26, 1978.
[3] Badger, F.H., Rockwell International Internal Letter, *Re: Evaporator Fire*, May 15, 1978.
[4] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Decon 2, RIHL (T020), 9 Feb 79*. February 12, 1979.

operating techniques, but in haste did not execute them properly (Incident Report A0088).[1]

- On July 13, 1982, SEFOR fuel pin #662 was declad, crushed, and loaded into a transfer tube. The tube was crimped and leak checked. The leak check revealed the tube to be leaking grossly. The tube was returned to the crimping station in Decon #4 and recrimped between the bad seal and the fuel. Operators were not wearing respirators and on the second try they were not wearing gloves. Apparently, the primary crimping forced contamination out of the faulty seal contaminating the crimper and in turn the hands of the operators. The health physicist took some smears and went to count the smears while operators continued to work further contaminating equipment and clothing before realizing the problem. Personnel were contaminated up to 350,000 dpm alpha on their hands, elbows, shoulders, shirts, pants, show covers, and shoes. Air monitors in the area did not immediately indicate any activity increase. Decontamination of two employees was difficult. The SEFOR fuel contained plutonium and uranium oxide. The fines included approximately 2 µCi of mixed fission product and emitted approximately 2 µCi of alpha activity (Incident Report A0105).[2]

- On August 16, 1982, a radioactive alarm from Building 4020 went off. The emergency team arrived and saw a red warning light on flashing on top of Building 4478, the radioactive liquid waste building associated with Building 4020. Approximately 30 minutes after the alarm signaled, the emergency team had entered Building 4020 and 4478 and reported that normal readings. The maintenance department replaced and tested the radioactive alarm system and all areas were secured (Incident Report A0325).[3]

- On October 11, 1982, an employee was working at the SEFOR decladding glove box repairing some remote equipment. He removed his gloved hands from the box and as he walked to the alpha survey meter to survey his gloves he wiped sweat from his brow with the inside of his lab coat. Upon surveying, he discovered his lab coat to be contaminated to approximately 80,000 dpm alpha and his forehead to be 8,400 dpm alpha. He also contaminated his hand to 2,400 dpm alpha when removing his coat and gloves. Another employee trying to assist contaminated his shirt to 400 dpm alpha. The floor was found to have 750 dpm of alpha contamination. The SEFOR fuel contained plutonium oxide (PuO) and uranium oxide (UO^2) (powder). Personnel, clothing, equipment, and the floor were decontaminated to background. The ruptured glove box was changed out (Incident Report A0110).[4]

- On December 22, 1982, an employee was operating manipulators in the SEFOR glove box and had a seizure. The employee collapsed on the floor in Decon #4, a secondary

[1] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020-Hot Storage Rm. & Airlock, 08-21-81*. August 26, 1981.
[2] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological safety Incident Report, RIHL – T020, 07-13-82*. July 15, 1982.
[3] Oliver, D.E., Rockwell International Internal Letter, *Re: R.A. Alarm, Bldg. 478.* August 17, 1982.
[4] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 – Decon 4, Box, 10-11-82*, October 15, 1982.

plutonium-239 (Pu-239) containment area. The employee was taken to the hospital. All personnel were found free of contamination. Decon #4 was mopped as a precaution, but no activity was found (Incident Report A0112).[1]

- On April 21-22, 1983, while fuel rods where being transferred between Building 4020 and RMHF, an error in SEFOR rod identification caused Building 4020 to exceed its established fuel transfer control criticality limit of 1,900 grams (g) of Pu overnight. When one of the rods was bagged into the glove box a check determined the rod number to be A-03 instead of 803. Rod A-03 contained an additional 213.58 g of Pu than Rod 803 and thus the transfer records and Hot Lab balances were incorrect. The additional Pu caused an exceedance of the control limit. However, all but 600 g Pu was secured in transfer casks as only one rod was out of the cask and in the glove box at any time. A handwritten note from R.J. Tuttle states that the established criticality limit of three rods was not exceeded. It was recognized that the numbers stamped or etched on fuel rods are often in poor condition and are difficult to identify. RMHF personnel had misread Rod A-03 and Rod 803. Further fuel transfers were stopped when the error was discovered. No contamination was released (Incident Report A0262).[2]

- On July 15, 1983, an employee was preparing to change out a leaded glove with a plastic bag in the SEFOR glove box in Decon #4 when he checked his gloved hands and detected alpha contamination. He proceeded to the Decon Room doorway to request health physics support and plastic bags to collect waste. At this point the air monitor at the glove box alarmed. Two employees and another operator decided to complete the change out operation. They donned respiratory protection and the operator also donned a hood and reentered the area. An alpha survey indicted contamination only on the glove port. The employees proceeded with the change out and during this operation the inside glove keeper rings, installed as an additional precaution because of the stiffness of the leaded glove, snapped off. A quick survey indicated gross alpha contamination (greater than 50,000 cpm) on the hood, mask, and lab coat of the operator as well as the glove port and the immediate surrounding area. They immediately evacuated. Two health physicists carefully removed contaminated articles from the operator. Activity levels between 30,000 and 50,000 cpm alpha were detected. The gross activity was removed before the operator's face respirator was removed. The operator was released to the showers. The area in front of Decon #4 was covered with plastic and the remainder of the service gallery was made a shoe cover area and secured. This area and the Decon Room were decontaminated to background levels (Incident Report A0120).[3]

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[1] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Decon 4 T020, 12/22/82.* December 23, 1982.
[2] Allen, D.C., Rockwell International Internal Letter, *Re: Excessive Pu Balance in RIHL, Building 20, MBA-54.* May 13, 1983.
[3] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020, Decon Room 4, Alpha Box, 07-15-83.* October 18, 1983.

- On August 8, 1983, a leaking transfer tube contaminated an employee and the decontamination room (Incident Report A0119).[1]

- On October 11, 1983, an anti-siphon valve was not closed on a pump in Cell #3 used to pump distilled water into SEFOR electropolish acid for neutralization and solidification. When the pump was shut off, acid was siphoned back into the 5-gallon container of distilled water, contaminating the water to an activity level between 2 and 6 microcuries per milliliter (µCi/ml). Another pump was then tested in the supposedly clean distilled water reservoir and transferred to the shop area. Water was spilled at the disconnect point, work table floor, and at the work bench in the shop. A cell operator at Cell #3 discovered the contamination and further surveys of the facility revealed contamination has been unknowingly spread throughout the building, with the exception of the Equipment Room, Generator Room, Battery Room, and their hallways.

  Contamination levels ranged from 1,500 cpm (~6,000 dpm/15 cm^2) beta-gamma to more than 100,000 cpm (450,000 dpm / 15 cm^2) beta-gamma. Ninety-five percent of the gamma emission was Cs-137 and the other 5 percent was cobalt-60 (Co-60). Only the sample from the distilled water reservoir indicated any trace of americium-241 (Am-241), and thus the presence of transuranic (TRU) contamination. The liquid spill was estimated at 25 ml. Smears of the area indicated approximately 0.1 percent alpha activity. Decontamination of the suspect low-level areas was accomplished by masslinn mops. Areas of higher contamination were hand wiped, stripped, and/or disposed of. A section of tile in front of Cell #3 had to be removed as did patches of carpeting in the front office. No contamination was found outside Building 4020 and no airborne activity was detected (Incident Report A0118).[2]

- On January 30, 1984, a contaminated electrode was worked on a clean grinder. Contamination was discovered on floors and on the clothing of the grinder operator. No other personnel, tools, or locations were found to be contaminated (Incident Report A0122).[3]

- On August 20, 1984, an employee entered Cell #3 for repair of a laser. During the course of the operation, the employee bumped his head on a metal frame causing an abrasion that drew blood. The abrasion was covered with a surgeons cap, canvas hood, and plastic hood. A survey and smear of the wound after exiting the cell did not indicate any activity (Incident Report A0125).[4]

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[1] The original incident report is identified as missing from Boeing's incident files. No other details are available on this incident at this time.
[2] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 and Cell 3 Face, 10-11-83*. October 13, 1983.
[3] The original incident report is identified as missing from Boeing's incident files. No other details are available on this incident at this time.
[4] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T-020 – Cell 3, 8-20-84*, Undated.

- On August 21, 1984, two new employees dressed in lab coats, shoe covers, and gloves were doing general cleanup in Decon #3. They found an open bag of tools and wiped the tools down. After exiting Decon #3, a routine survey showed contamination on their pants up to 50,000 dpm beta-gamma. The employees removed their pants and were found to be clean. A survey of the tools indicated up to 1 x 10^6 dpm beta-gamma. All areas involved were surveyed and decontaminated. The incident report notes that a more experienced employee may have recognize the potential for release of contamination and bagged the tools before removing them from the cell (Incident Report A0126).[1]

- On October 15, 1984, during remote decontamination of Cell #3, a small puddle of alcohol ignited. A nitrogen purge was started and the fire went out almost immediately. There was no nuclear fuel in the cell at the time. No increase in stack monitor activity was observed and the incident report states that there was no release to the environment (Incident Report A0127).[2]

- On October 26, 1984, an employee inadvertently grabbed a bag of radioactive waste in the Manipulator Repair Shop with his bare hands and contaminated his left hand to approximately 5,000 dpm and his right hand to approximately 7,500 dpm. His hands were successfully decontaminated below detection levels after three applications of soap and water (Incident Report A0128).[3]

- On December 6, 1984, an employee conducting routine cleanup in Cell #1 reached his arm up causing his protective clothing to separate from his taped-on surgeon gloves. The employee immediately went to the Decon Room for repair. Upon completion of his work, the employee surveyed his right forearm/wrist and found it was contaminated to 500,000 dpm beta-gamma. The contamination was from irradiated Fermi fuel fines in Cell #1. After considerable effort, the contamination level on the employee's arm was reduced to background and the employee was released (Incident Report A0129).[4]

- On December 10, 1984, an exit survey of an employee conducting cleanup in Cell #1 revealed contamination on his neck at 25,000 dpm beta-gamma and contamination on his forearm at 5,000 dpm beta-gamma. The contamination was from irradiated Fermi fuel fines in Cell #1. The employee was decontaminated to background levels (Incident Report A0130).[5]

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[1] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T-020 Decon Room 3, 8/21/84*, August 27, 1984.
[2] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Cell 3, 15 Oct. 84.* October 16, 1984.
[3] Dickson, F.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, RIHL Manipulator Repair Shop, 10/26/84*. November 5, 1984.
[4] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T-020 Cell 1, 12/6/84*. December 11, 1984.
[5] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Cell 1, 12/10/84*. December 13, 1984.

- On December 10, 1984, an exit survey of an employee conducting cleanup in Cell #1 revealed 1,500 dpm beta-gamma contamination on his left hand. The contamination resulted from irradiated Fermi fuel fines in Cell #1. The activity was successfully removed and the employee was released (Incident Report A0131).[1]

- On December 10, 1984, an incident report was filed concerning an employee who had made two entries into Cell #1 to decontaminate the cell and remove equipment that had been used for a Fermi fuel decladding task. After the second entry found his company thermoluminscent dosimeter (TLD) finger rings indicated 11,954 mrem on his right hand and 5,927 mrem on his left hand. The employee was excluded from further radiation work and the vendor TLD finger rings were sent for emergency processing. The vendor TLDs measured 7,750 mrem for the right hand and 7,710 mrem for the left hand. These measurements exceeded the Atomics International Energy Systems Group Health and Safety internal limits of 4,500 mrem per quarter. The employee was temporarily restricted from work with radiation exposure and recommendations for improved safety were made (Incident Report A0133).[2,3]

- On January 14, 1985, an employee moved a bag of contaminated material in Decon #1 that had not been properly taped closed. A section of hose came out of the bag and contacted his right leg. The employee immediately exited the area. A survey of his pant leg showed a detectable activity of 2,500 dpm beta-gamma radiation. The pants were removed and no skin contamination was found (Incident Report A0134).[4]

- On January 15, 1985, an employee repairing radiologically contaminated master manipulators accidentally sliced his glove with a screwdriver and caused a 3/8-inch cut in the knuckle of his left hand. The employee immediately exited the area. A survey of the wound revealed no detectable activity and a smear of blood from the wound found no activity above background. A shielded high purity germanium detector found a slightly positive peak of cesium at about 100 dpm. The employee's hand was decontaminated (Incident Report A0132).[5]

- On February 20, 1985, an employee working on a gear shaft for Cell #4 door cut his finger on a sharp edge of the shaft. A 1/4-inch cut on his finger was scanned for potential

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[1] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Cell 1, 12/10/84*. December 13, 1984.
[2] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T-020 Cell 1, 12/7 and 12/10/84*, Undated.
[3] Meyer, R.D., Rockwell International Internal Letter, *Re: Hand Exposure Incident RIHL, December 10, 1984*, December 20, 1984.
[4] Giesler, C., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T-020 Decon #1, 1/14/85*, January 21, 1985.
[5] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T-020 Hot Manipulator Repair Shop, 1/15/85*, January 17, 1985.

radioactive contamination, but no detectable activity was found on finger. A smear survey of the shaft found no detectable activity (Incident Report A0135).[1]

- On March 4, 1985, an employee working in Cell #1 had sharp objects pierce his clothes and two pair of plastic booties. This allowed water being used for decontamination to leak into the booties and contaminate both shoes. Attempts at decontamination were unsuccessful. A final survey showed a maximum of 25,000 dpm contamination on the shoes and they were discarded as radioactive waste. No skin contamination was found on the employee (Incident Report A0136).[2]

- On March 20, 1985, two employees were assisting during the removal of solidified EBR-II liquid waste from Cell #2. One of the 55-gallon drums that the waste was to be placed in contained a "5-20 pig" that was removed from Cell #1 during cleanup operations for that cell. The pig was radioactively contaminated from Fermi fuel operations in Cell #1. The pig was wrapped in three plastic bags and placed in the drum with cement added for additional shielding. When personnel pulled off the lid of the drum contaminated rust, dirt, and concrete spilled and was spread to personnel and the surrounding area. One employee's lab coat sleeves had a reading of approximately 100,000 dpm beta-gamma and a masslinn wipe showed a maximum contamination of approximately 500,000 dpm beta-gamma in the area of the spill. The employees and area were decontaminated to below 20 dpm/ 100 cm^2 alpha and below 50 dpm /100 cm^2 beta-gamma (Incident Report A0137).[3]

- On June 6, 1985, an employee was decontaminating manipulators from Cell #3 in the Hot Manipulator Repair Shop when a radiologically contaminated solution of nitric and hydrofluoric acid seeped through his coveralls onto his left forearm. His arm was found to have 1,500 cpm beta-gamma contamination, but no alpha contamination. The employee was eventually decontaminated to background (Incident Report A0139).[4]

- On August 15, 1985, an employee packaging contaminated glass from a SNAP program hydrogen analyzer had a small splinter of glass protrude through his protective gloves. It caused a small puncture wound to his index finger. A frisk survey found no detectable beta-gamma contamination, but a blood smear from the wound showed less than 10 dpm/100 cm^2. An "MCA" scan of the hand showed a small amount of Cs-137 (Incident Report A0140).[5]

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[1] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020/Shop Area, 2/20/85*, February 22, 1985.
[2] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020, 3/4/85*, March 14, 1985.
[3] Giesler, C., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Service Gallery, 3/20/85*. April 2, 1985.
[4] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Hot Slave Shop, 6/6/85*,. June 10, 1985.
[5] McGinnis, R., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, SSFL/T020 Decon #1, 8/12/85*. August 15, 1985.

- On October 4, 1985, a cold employee was assisting in the service gallery during the loading of radioactive contaminated materials from Cell #2 into a containment box. The employee was dressed in red-line coveralls, booties, gloves, and was wearing his personal clothing underneath. Upon exiting the area a personnel survey indicated the employee's shirt was contaminated with up to 2,000 dpm beta-gamma and his pants were contaminated up to 1,000 dpm beta-gamma. Decontamination was successful on the employee's pants, but his shirt had to be discarded as radioactive waste (Incident Report A0142).[1]

- On October 17, 1985, an employee size reducing contaminated material in Cell #3 had sharp metal material penetrate two pairs of plastic booties and one pair of cloth booties contaminating the employee's shoes to approximately 2,500 cpm beta-gamma. The sharp metal pieces were produced from the power saw used to size reduce material before it was removed for disposal. Decontamination of the employee's shoes was unsuccessful and the shoes were discarded as radioactive waste (Incident Report A0141).[2]

- On October 25, 1985, an employee existing Cell #3 discovered several parts of his body were contaminated. Contamination was a high as 10,000 cpm beta-gamma. The activity appeared to come from the protective coveralls he was wearing. The incident report notes that strong evidence suggests the contamination came from the laundry and that future laundry will be surveyed prior to acceptance (Incident Report A0147).[3]

- On November 4, 1985, an employee performing decontamination activities in Cell #3 found 10,000 cpm beta-gamma contamination on his forearms in a routine exit survey. The contamination was reduced to 200 cpm and the employee was release. A survey taken the following day did not detect any activity on his forearms. The incident report notes that the contamination appears to have been the result of improperly laundered protective clothing even though the clothing was checked before use and found to be below 1 mrad (Incident Report A0148).[4]

- On November 13, 1985, an employee working in Cell #3 discovered that his shoes had become contaminated to 30,000 dpm/100 cm^2 beta-gamma. The suspected cause of fixed contamination on the shoes was leaching of contamination from red-line socks during sweating. According to the incident report, the laundry service had discovered a problem in their water cleanup system. The laundry service noted the problem was corrected and

[1] Giesler, C., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020/Cell #2, 10/4/85.* October 29, 1985.
[2] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020/Cell #3, 10/17/85.* October 28, 1985.
[3] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 – Cell #3, 10/25/85*. December 9, 1985.
[4] Badger, F.H., Rockwell International Internal Letter: *Re: Radiological Safety Incident Report, T020 Cell #3, 11/4/85*. December 10, 1985.

contaminated socks were being isolated and removed from the system (Incident Report A0145).[1]

- On November 20, 1985, an employee discovered beta-gamma contamination on his left shoe after exiting Cell #4. Further investigation showed that the source of contamination was fixed contamination from his red-line socks sweating through to his shoes. It is not clear from the incident report where the original source of fixed contamination came from. The employee's shoe was contaminated to 250,000 dpm /100 cm^2. Decontamination attempts were unsuccessful. A note on the incident report states "[t] his is one of several incidents related to break down at vendor laundry" (Incident Report A0143).[2]

- On November 21, 1985, an employee working in Cell #3 discovered his shoes had become contaminated to 50,000 dpm /100 cm^2 beta-gamma. Investigation found the source of fixed contamination was inside his shoe from the leaching of contaminated red-line socks during sweating. Decontamination of the shoes did not work. The laundry service was contacted and it found a problem with its water cleanup system. According to the laundry service, the problem had been corrected and contaminated socks were being isolated and removed from the system (Incident Report A0144).[3]

- On November 22, 1985, an employee in Decon #4 discovered his shoes were contaminated to 25,000 dpm /100 cm^2 beta-gamma. The source of contamination was suspected to be leaching of contaminated red-line socks during sweating. The laundry service was contacted and it found a problem with its water cleanup system. According to the laundry service, the problem had been corrected and contaminated socks were being isolated and removed from the system (Incident Report A0146).[4]

- On December 10, 1985, an employee loading contaminated material into a containment box inside the Hot Storage Room got his right hand pinched between the box and a piece of equipment. He removed his outer pair of gloves and noted that his middle finger was bleeding. The inner glove was not penetrated and no detectable contamination was found through blood smears or other surveys (Incident Report A0149).[5]

- On January 14, 1986, a review of recent non-reportable incidents at Building 4020 was conducted (Incident Report A0150).[6]

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[1] McGinnis, R., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, SSFL, T020, Cell #3, 11/13/85*. November 27, 1985.
[2] McGinnis, R., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, SSFL: Building T020; Cell #4, 11/20/85*, November 25, 1985.
[3] McGinnis, R., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, SSFL, T020, Cell #3, 11/21/85*, November 27, 1985.
[4] McGinnis, R., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, SSFL, T020, Decon #4, 11/22/85*, November 27, 1985.
[5] Giesler, C., Rockwell International Internal Letter: *Re: Radiological Safety Incident Report, T020 Hot Storage, 12/10/85*, December 16, 1985.
[6] The original incident report is identified as missing from Boeing's incident files. No other details are available on this incident at this time.

- On February 4, 1986, an employee working in Cell #4 was instructed to leave when the breathing air system shut down. The employee was able to breathe due to residual air still within the system. Once the employee had exited the area, a personal survey showed no detectable activity. The breathing air system was eventually reset from the control box on the west side of Building 4020 (Incident Report A0151).[1]

- On February 19, 1986, an employee working in the Glove Box Room (Room No. 139) picked up the top cover of a filter bank unit and a sharp edge pierced his plastic gloves and cut his right index finger. He exited the area and a blood smear and survey were taken. No detectable activity was found (Incident Report A0152).[2]

- On March 4, 1986, an employee was cleaning radioactive contaminated tools in the mask cleaning area of Building 4020. He accidentally splashed the cleaning solution of Alconox and water in his eye. The employee, who was wearing safety glasses at the time, immediately left the area. A radiation survey of the eye showed no detectable activity and the employee was sent to medical to have his eye flushed. A 250 mL water sample of the cleaning mixture was collected and scanned. No detectable activity was found (Incident Report A0155).[3]

- On April 16, 1986, a routine inventory leak check found that a 1.5 mCi Sr-90 check source was missing. A search of Building 4020 failed to identify its location. A recent effort to remove all contaminated equipment from the Hot Storage room and decontaminate the area generated several 19a boxes of radioactive waste. It was felt with a good degree of confidence that the missing source that was wrapped in a plastic bag marked "save" was instead disposed of in one of the waste boxes (Incident Report A0156).[4]

- On October 28, 1986, sparking of Fermi fuel assembly #204 occurred, igniting zirconium saw chips during the sawing phase of disassembly operations in Cell # 4. Saw cutting operations were halted and the cell atmosphere was immediately purged with nitrogen to extinguish the ignited chips. Further disassembly operations were halted until the incident was investigated and preventive measures implemented. It was determined that the band saw got close enough to the uranium fuel during cutting of the zirconium end caps that the friction of the saw on the uranium metal sparked and ignited the zirconium chips collecting at the bottom of the saw blade. To prevent further incidents numerous action items were carried out. A drip system was installed on the saw and a wet vacuum

[1] Giesler, C.A., Rockwell International Internal Letter: *Re: Radiological Safety Incident Report, T020 Cell #4, 2/4/86*, February 17, 1986.
[2] Giesler, C., Rockwell International Internal Letter: *Re: Radiological Safety Incident Report, T020 Rm#139, 2/19/86*. February 19, 1986.
[3] Giesler, C.A., Rockwell International Internal Letter: *Re: Radiological Safety Incident Report, T020 Service Galley, 3/4/86*. March 13, 1986.
[4] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020, SSFL, 4/16/86*. April 21, 1986.

was modified for remote handling to remove saw chips after cutting each assembly (Incident Report A0165).[1]

- On March 12, 1987, during a routine work in Cell #4, an employee began complaining about not feeling well. He was advised to begin exit procedures. With assistance from another hot man and a hot/cold man, the employee's outer protective clothing was removed. The employee then blacked out, but was caught and placed onto clean plastic sheeting. A Radiation & Nuclear Safety Group representative was called to help with contamination control and the remainder of the employee's protective clothing was removed. The employee regained consciousness and was dressed in a clean pair of coveralls after being found free of radiological contamination. He was taken to Rockwell's Santa Susana Field Test Laboratory Medical Station for monitoring. It was determined that the employee was suffering from heat exhaustion due to increased cell air temperature, higher than normal face mask pressure, and a difficult working position. All personnel and equipment were monitored prior to leaving the controlled area and no contamination was detected (Incident Report A0173).[2,3]

- On July 10, 1987, an employee exiting Cell #2 was found to have approximately 20,000 dpm/beta-gamma contamination on his right wrist. The employee's wrist was successfully decontaminated using dry wipes. The incident report notes that personnel should take more precaution when taping up prior to entries into radioactive contaminated areas (Incident Report A0174).[4]

- On July 14, 1987, an employee exiting Cell #2 found radioactive contamination up to 70,000 dpm beta-gamma on his neck. The employee's neck was successfully decontaminated using dry and wet wipes. The incident report notes that excessive sweating by personnel who are suited up sometimes causes the tape to clothing seal to come loose and if this is noticed the operation should stop and the clothing should be retaped (Incident Report A0175).[5]

- On July 20, 1987, an employee working in Cell #2 found contamination on his neck after an exit survey (Incident Report A0177).[6]

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[1] Harrison, D.J., Rockwell International Internal Letter, *Re: Report on Ignition Incident during Disassembly of Assembly #204 on October 28, 1986 and Minutes of Review Committee Meeting on October 29, 1986*, October 30, 1986.
[2] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, RIHL T020, Cell 4, 3/12/87*, March 20, 1987.
[3] Babcock, E.L., Rockwell International Internal Letter*, Re: Cell 4 Fainting Incident*, April 24, 1987.
[4] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Cell #2, 7/10/87*, Undated.
[5] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Cell #2, 7/14/87*, Undated.
[6] The original incident report is identified as missing from Boeing's incident files. No other details are available on this incident at this time.

- On October 15, 1987, an employee performing a personal survey after bagging radioactive waste from Decon #1 found the right knee of his pants was contaminated to approximately 5,000 dpm beta-gamma. The pants could not be decontaminated below 2,500 dpm beta-gamma so they were taken as radioactive waste (Incident Report A0178).[1]

- On December 1, 1987, an employee caught his thumb between a forklift cross member and chain while removing a shield plug for Cell #1. Blood was noticed inside of his glove and he immediately exited the controlled area. A blood smear and survey of his thumb found no detectable contamination (Incident Report A0181).[2]

- On December 17, 1987, an incident occurred at a sump pump and employees entered a confined space without the proper permits or approval (Incident Report A0182).[3]

- On June 13, 1988, two security guards became concerned when a radiation monitor in a basement alcove of Building 4020 went off-scale and alarmed in their presence. They called the facility health physicist, who told the guards that no radiation exposures could occur in that area based on current activities in the building, but that they should put on shoe covers and survey their shoes in the lobby of Building 4020 as a precaution and call the health physicist back if there were any problems. The alarm had shorted in the past and was not trusted. The security guards requested an independent reading of their film badges to ease their fears as they were new to operations on "the hill" and didn't know who or what to believe. Independent analysis found no radiation exposure. The radiation monitor was tested the next day and alarmed erroneously three times. It was replaced and sent for repair (Incident Report A0185).[4,5]

- On September 30, 1988, an employee was performing a personal radiological survey upon exit from Cell #1 and found a maximum of 3,500 dpm beta-gamma on his right knee. After repeated use of wet and dry wipes the area was successfully decontaminated. The employee notes he could have become contaminated when picking up a piece of material with clear hydraulic fluid on the outside (Incident Report A0190).[6]

- On October 10, 1988, an employee was performing a personnel survey upon exit from Cell #1 and found his forearms and left knee were contaminated. A maximum of 10,000

[1] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020/Decon #1, 10/15/87*, March 23, 1987. (Either the incident date or the letter date are incorrect.)
[2] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, T020 Operating Gallery, 12/1/87*, December 21, 1987.
[3] The original incident report is identified as missing from Boeing's incident files. No other details are available on this incident at this time.
[4] Rowles, J.A., Rockwell International Internal Letter, *Re: June 13, 1988 Security Guard Incident at T020*, July 1, 1988.
[5] Badger, F.H., Rockwell International Internal Letter, *Re: After Hours Alarm*, June 16, 1988.
[6] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Building 20 Cell #1, 9/30/88*, October 17, 1988.

dpm beta-gamma was found on his left forearm. Repeated use of wet and dry wipes decontaminated the area (Incident Report A0191).[1]

- On November 14, 1988, an employee was doing decontamination and demolition (D&D) work in the Hot Storage Room (Room #153) and when cutting wire mesh a sharp piece punctured his left glove and cut his finger. The employee immediately left the area. A blood smear and survey did not detect any radioactive contamination (Incident Report A0192).[2]

- On January 4, 1989, an employee performing a personnel survey upon exit from Cell #1 found that his chin was contaminated. A survey meter found approximately 3,500 dpm beta-gamma contamination. A nasal smear found a maximum of 127 dpm beta-gamma contamination. Another sample found approximately 250 dpm of Cs-137. The employee was dressed out in full face respirator with cartridge, coveralls, gloves, hood, and booties. The incident report implies the employee's tape seal came loose and he ultimately inhaled radioactive materials (Incident Report A0193).[3]

- On June 6, 1989, two employees conducting D&D operations in Cell #1 were found to be contaminated upon exiting the cell. The employees were removing inner cell windows that had been in place several years and had collected contamination over time. The employees had to hold the windows next to their protective coveralls and the contamination penetrated their coveralls. One employee contaminated his left inner thigh (12,000 cpm beta-gamma) and both forearms (800 cpm beta-gamma). The other employee contaminated his right knee (6,000 cpm beta-gamma). After repeated use of wet and dry wipes and decontamination in the hot shower, the employees were surveyed and found to be clean (Incident Report A0198).[4]

- On June 29, 1989, two employees became contaminated while working on electropolishing operations in Cell #2 and Decon #1. One employee received a maximum of 7,000 cpm and the other employee received a maximum of 1,000 cpm. The personnel were successful decontaminated using wet and dry wipes and a final survey showed no skin contamination. The incident report states that the contamination was thought to come from the red-line laundry as several articles of clothing were surveyed and found to have higher than normal readings. These items were packaged and sent back to the laundry cleaning company (Incident Report A0199).[5]

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[1] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Building 20 Cell #1, 10/10/88*, November 8, 1988.
[2] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Bldg 20 Room #153, 11/14/88*, November 21, 1988.
[3] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Building 20 Cell #1, 1/4/89*, January 11, 1989.
[4] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Building 20 Cell #1, 6/6/89*, June 29, 1989.
[5] Giesler, C.A., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Building 20 Cell #2 & Decon #1, 6/29/89*, July 18, 1989.

- On October 4, 1989, an employee punctured the skin on his right forearm while working in the glove box room for plutonium handling. Although Pu-239 contamination was possible, a survey found no contamination above background (Incident Report A201).[1]

- On December 15, 1989, during a scabbling operation of contaminated concrete on the loading dock pad one of two absolute vacuums in use lost filtration. Concrete dust was release from the vacuum and became airborne in the airlock. Operations were stopped and both vacuums were shut down until a survey could be performed. No personnel were in the airlock at the time of the incident (Incident Report A0587).[2]

- On April 18, 1990, an employee working in Cell #2 cut his radial artery when a steel chip from the top of a jackhammer chisel penetrated his left wrist. The chip was contaminated to 120 pCi (Incident Report A0205).[3,4]

- On July 17, 1990, an employee working in Cell #3 had a ladder slip out from under him and contaminated his left forearm and elbow to 300 cpm (Incident Report A0207).[5,6]

- On October 17, 1990, employees dropped a duct section, causing elevated airborne activity (Incident Report A0210).[7]

- On December 17, 1990, employees arriving for work in the morning observed a red beacon alarm on Building 4020. The emergency response team responded and found the gamma monitor in Liquid Waste Building 468 to be reading 100 mR even though the actual gamma radiation in the area was 2 mR. The alarm set point was approximately 20 mR above background. The gamma monitor in Building 468 was disconnected and the Building 4020 alarm immediately ceased. The monitor in Building 4020 remains in service, while the Building 468 monitor was removed for repair (Incident Report A0213).[8]

- On August 26, 1991, during decontamination activities in Cell #3, three plugs used as a contamination barrier were blown out of cell ports by sandblasters into the operating gallery clean area. A small amount of dry sandblast grit from Cell #3 was discharged onto the operating gallery floor and on one wall. Initial large area masslinn wipes in the

[1] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Bldg. 20 Rm 139, 10/4/89*, October 30, 1989.
[2] Unknown Author, Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Airlock, 15 Dec 89*, Undated.
[3] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Cell 2 – Bldg. 020 – RIHL, 4/18/90*, Undated.
[4] This incident report is extremely brief and cites an attachment to the report. This attachment has not been located.
[5] Badger, F.H., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Bldg 20 Hot Cell #3, 7/17/90*, July 31, 1990.
[6] This incident report is brief and cites an attachment to the report. This attachment has not been located.
[7] The original incident report is identified as missing from Boeing's incident files. No other details are available on this incident at this time.
[8] Schrag, F.C., Rockwell International Internal Letter, *Re: Radiological Safety Incident Report, Occurrence #RD-90-4-RIHL-90-3*, December 17, 1990.

area showed a contamination of approximately 1,000 dpm/100cm2 in the spill area and 300 to 500 dpm/100cm2 on the entire floor of the operating gallery. The continuous air monitor was in service and did not alarm or show any increase in airborne radioactivity. Masslinn smears were taken in adjacent rooms and showed no activity above background. The operating gallery area was de contaminated using a vacuum cleaner for visible deposits and masslin and moist towels for floors and horizontal surfaces (Incident Report A0267).[1,2]

- On June 17, 1993, an employee became contaminated during decommissioning and decontamination operations of a radioactive exhaust duct in the Building 4020 basement. The employee was contaminated up to 2,000 cpm, and was taken to the RMHF for decontamination. All contamination was removed to less than background levels (Incident Report A0571).[3]

- On September 15, 1993, an employee jack hammering drain piping in Cell #3 found his dosimeter went off scale after working in this high radiation area. The work involved repeatedly jack hammering in the high radiation area then moving to a low dose waiting area and the employee became complacent with this repetitive task. Investigation of the incident revealed that worker error caused the unacceptable exposure. The employee's dose for the week (204 mrem), quarter (500 mrem), and year (650 mrem) were all below Rocketdyne's administrative limits of 300, 1,000, and 2,000 mrem respectively (Incident Report A0575).[4]

- On May 10, 1995, two operations mechanics dumped a vacuum catch drum into a waste box during repackaging operations. Vacuum catch drums were not authorized for dumping because of the light density of the material and the contamination levels. This activity had the potential to cause a loss of contamination control by release radioactivity to the air. A survey of the area found a maximum of 2,589 dpm/100 cm^2 beta-gamma contamination. Results found inside a respiratory protective device were 9.0×10^{-14} µCi/cc alpha contamination and 7.4×10^{-12} µCi/cc beta contamination. The area was decontaminated to less than 20 dpm/100 cm^2 beta within one hour of the incident. No personal contamination was discovered (Incident Report A0662).[5]

- On April 15, 1996, an employee's right shoe became contaminated with a particle from saw cutting operations of contaminated concrete. The particle read 600 net counts per minute (ncpm) by direct frisk survey. The particle was removed with tape and the

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[1] Cutting, R., *U.S. Department of Energy Occurrence Report, Occurrence Report #SAN-RD-RIHL-0005*, August 27, 1991.
[2] Meyers, R.L., *Handwritten Notes Re Occurrence on August 26, 1991*.
[3] Hickman, D.W., Rockwell International Internal Letter, *Re: Radiological Safety Report, Building 20 Basement, 6/17/93*, June 29, 1993.
[4] Harcombe, R., Rockwell International Internal Letter, *Re: Radiological Safety Report, RIHL T020, 9/15/93*, September 16, 1993.
[5] Harcombe, R., Rockwell Internal Letter, *Re: Radiological Incident Report, Dumping of Vacuum Catch Drum Without Notification, A0662, SSFL, Area IV, T020, Decon 3, 5/10/95*, June 13, 1995.

employee was determined free of contamination. A particle survey of the work area was conducted, but no additional particles were detected (Incident Report A0668).[1]

- On August 15, 1997, a contract worker found his boot had a hole in it and the boot was wet and contaminated. A health physics technician surveyed the boot and found 1,400 ncpm on the pancake frisker. The contamination was too embedded to decontaminate. Personnel were reminded check protective clothing prior to donning and to not use worn out articles of clothing (Incident Report A0679).[2]

- On August 15, 1997, a health physics technician observed a worker at the step-off pad undressing improperly. The worker was removing a paper suit barehanded because he had improperly removed his glove first. The technician intervened and frisked the worker's hand finding 1,400 cpm on it. The worker's hand was decontaminated. The worker was informed of the proper undress procedure and that additional instances could result in suspension of access privileges (Incident Report A0678).[3]

[1] Harcombe, R., Rockwell Internal Letter, *Re: Radiological Incident Report, Contaminated Right Shoe, A0668, SSFL, Area IV, T020, Service Gallery, 4/15/96*, April 16, 1996.
[2] Deschamps, R., Boeing Internal Letter, *Re: Incident Report, Contamination Found on the Shoe of Contractor for Heil, A0679, T020, 8/15/97*, April 15, 1998.
[3] Deschamps, R., Boeing Internal Letter, *Re: Incident Report, Radioactive Contamination Found on the Left Hand of Contractor for Heil, A0678, SSFL, T020, 8/15/97*, April 15, 1998.

BUILDING 4055

- On May 9, 1970, an employee was involved in a contamination incident while working in Glove Box #9 at Building 4055. According to the incident report, upon withdrawing his hands from the glove box, the employee discovered a hole in the glove box glove. Upon discovery of the hole, the employee left his arms in the glove box. Upon arrival of the facility's health physics representative, the alpha scintillator contamination monitor located approximately 4 feet behind the employee was "off scale." An alpha meter was brought into the area and contamination levels of 100 cpm were measured on the employee's left arm. The employee was monitored and it was found that his shirt sleeves were contaminated to 50 cpm. The shirt was disposed of as radioactive waste.

  Cover plates were placed over the glove box gloves and the gloves were changed without incident. A survey of the floor and surfaces around Glove Box #9 found elevated concentrations of 60 cpm on the floor in one spot. The spot was cleaned up with "windex and a kimwipe." Contamination levels on all other surfaces were at "normal background levels." The incident report does not state what the normal background levels were in 1970 (Incident Report A0286).[117]

- On June 27, 1973, a comprehensive smear survey of the glove box room found that contamination was spread throughout the room, including the overhead pipes and ductwork. The absolute filters located adjacent to Glove Box #17A were surveyed and the Model FM-5 Alpha Survey meter indicated 10,000 cpm on Filter 5 and 9,000 cpm on Filter 6. During the survey, it was noted that a considerable amount of dust was present on the top of the boxes, cabinets, pipes, and ductwork. According to the report, it was thought the use of an absolute type vacuum cleaner could remove a majority of the contamination along with the dust. The incident report did not provide information to indicate how the glove box room was ultimately decontaminated (Incident Report A0222).[118]

- On December 21, 1977, a contaminated roll of green tape was discovered in the glove box room. A monitor of the tape read approximately 3,700 cpm. A low level of alpha activity was discovered on the bench underneath the tape and was contained. The incident report did not indicate the levels located on the bench; however, the report stated that "clear spray" was used to seal the contamination in place. No other contamination was found in the glove box room (Incident Report A0224).[119]

- On January 10, 1978, an employee became slightly contamination while foam-decontaminating Glove Box 26 when a rubber glove failed. The process of foam-decontamination, according to the incident report, involves introducing foam into the glove box, and scrubbing all accessible areas. The rubber glove had a small puncture tear

[117] Lane, W.D., Internal Letter *Re: Contamination Event in Building 055, A0286, May 21, 1970.*
[118] Klostermann, J.P., Internal Letter, *Re: Glove Box Failure in Building T055, July 5, 1973.*
[119] Owens, D.E., Internal Letter, *Re: Incident Report A0224, January 4, 1978.*

at the glove-to-box mounting ring. The incident reported noted that no liquid escaped from inside the box. The employee was found to be contaminated at his right side-burn hair area, with the Ludlum alpha meter indicating about 2,000 to 3,000 dpm activity. The hot sink at Building 4055 and mild soap were used to decontaminate the employee but residual contamination remained (630 dpm). The employee was instructed to shower at Building 4020, which resulted in no additional activity being detected on his head or body. The incident reported that there was no spread of contamination to any other area beside the glove box (Incident ReportA0063).[120]

- On May 10, 1978, a lost seal during the replacement of a rubber glove with a plastic bag caused loss of vacuum in Glove Box #22. Contamination of 100 dpm was subsequently discovered on the outside window area. The areas identified as being contaminated were "immediately decontaminated using standard methods and procedures." The incident report did not indicate what the standard methods and procedures were (Incident Report A0335).[121]

- On June 15, 1978, an employee compacted radioactive waste in a compactor reserved for non-radioactive "suspect" waste. Although compacting radioactive waste may have generated high airborne activity, the compactor had a filter that minimized the release of such contamination to the building (Incident Report A0071).[122]

- On July 16, 1978, a destructive electrical power surge on the main line causing damage to the main Building 4055 air sampling vacuum pump. The backup pump did not take over because of an internal leak in the water cooling jacket. This resulted in the loss of normal air sampling capability in the facility, including the stack monitors for approximately 12 hours. The incident report stated that the exhaust fans that maintained differential room pressures and glove box vacuums were not affected by the power failure. A check of each HEPA filter bank indicated no abnormal conditions or failures in the filtration system. The incident report noted that the only material that was available for release included a semi-fixed contamination on the interior surfaces of the glove box lines; however, all accountable material had previously been removed from the boxes (Incident Report A0072).[123]

- On July 24, 1978, floor contamination was found in the waste handling area. This contamination was assumed to have been caused by leakage from a stored waste container although none of the containers had external contamination (Incident Report A0073).[124]

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[120] Owens, D.E., Internal Letter, *Re: Radiological Occurrence at NMDF Involving Minor Personnel Contamination, January 10, 1978, February 15, 1978.*
[121] Owens, D.E., Internal Letter, *Re: Radiological Occurrence at NMDF, May 15, 1978.*
[122] Owens, D.E., Internal Letter, *Re: Notice of Safety Rule Violation. June 15, 1978.*
[123] Owens, D.E., Internal Letter, *Re: Incident Report, July 24, 1978.*
[124] Owens, D.E., Internal Letter, *Re: Incident Report Room Contamination at NMDF, August 1, 1978.*

- On June 26, 1979, airborne activity was released during the maintenance of a glove box. Personnel were removing and replacing the furnace heating element of Glove Box #4 when the "short-term" release of airborne alpha activity occurred. The activity consisted of plutonium and americium particles. Smears in the immediate area of Glove Box #4 found contamination of up to 75 dpm/100 cm2. The area floor was wet-mopped and the glove box furnace and immediate area was decontaminated. Following decontamination, a complete contamination survey of the building was performed with no detectable contamination found (Incident Report A0582).[125]

- On May 10, 1980, the air sample vacuum pump stopped working. There was no indication of a release of contaminants (Incident Report A0081).[126]

- On October 31, 1980, a health physicist was called to Building 4055 to survey four pair of green line coveralls that were returned with the blue line laundry. One pair of green line coveralls was found to have a small ball of "tar" inside at the belt line. The "tar ball" had beta contamination of 446,000 dpm. The other three pair of coveralls were surveyed for alpha and beta-gamma and were found to not be contaminated. The incident report did not indicate where the "tar ball" had originated from or how it was handled or disposed of following its discovery (Incident Report A0250).[127]

- On May 30, 1981, the air sample vacuum pump failed, resulting in the failure of the facility air monitoring system. The system was repaired and placed back in service on May 31, 1981. According to the incident report, radiation and nuclear safety personnel were not notified of the incident at the time of occurrence; however, it was determined that no release of contaminants was suspected (Incident Report A0085).[128]

- On November 7, 1981, a high airborne alarm at Building 4055 went off. When the health physicist arrived, the ALPHA III at Station "C" was alarming. Upon inspection, it was found that ALPHA III was functioning properly. A smear and direct survey of the area showed no contamination (Incident Report A0091).[129]

- On March 24, 1982, trace amounts of suspected plutonium contamination resulted when an employee was compacting suspect waste into a new "sphincter can," and a petri dish broke and cut the employee's right hand. A health physicist performed a contamination survey of the wounded area and no contamination above background was detected. The incident report recommended that glass items that are too large to be easily placed in a shipping can could be broken in a controlled area, and then the pieces could be

[125] Meyer, R.D., Internal Letter, *Re: Radiological Safety Incident Report, July 20, 1979.*
[126] Bradbury, S.M., Internal Letter, *Re: Radiological Safety Incident Report, May 29, 1980.*
[127] Bradbury, S.M., Internal Letter, *Re: Radiological Safety Incident Report, November 25, 1980.*
[128] Badger, F.H., Internal Letter, *Re: Radiological Safety Incident Report, June 1, 1981.*
[129] Bradbury, S.M., Internal Letter, *Re: Radiological Safety Incident Report, November 12, 1981.*

transferred to the shipping can. The incident report did not note the origin of the contaminated petri dish (Incident Report A0100).[130]

- On February 7, 1983, an employee was disassembling a balance in Glove Box #3A, when he jammed a small screwdriver through the box glove and surgeon's glove and inflicted a puncture wound at the base of his left index finger. A survey of the wound and finger indicated approximately 3,500 dpm alpha, and the surgeon glove indicated approximately 30,000 dpm alpha. Blood samples of his finger found contamination of 414 dpm alpha. The area was flushed with clean water and encouraged to bleed. A second blood sample taken indicated 39 dpm alpha. The process was repeated and the employee was taken to Building 4020 for an In-Vivo scan and for further decontamination. The area around the wound was decontaminated to background level and the employee underwent a 1,000 second count. The count data was found to convert to 2,300 dpm of AM-241 and the total activity in the wound was assumed to be approximately 7 nCi of plutonium plus americium. An area was set up at the SSFL First Aid Station and "debridement" of the wound site was performed. All equipment and waste were collected and the surgery area surveyed clean after the surgery was completed. Additional scans of the wound area indicated contamination of 2.8 nCi of plutonium plus americium. The employee underwent additional surgery to remove radioactive material from the wound site on March 16, 1983. A post surgery scan determined that between 90 to 100 percent of the active material was removed.

  the incident report did not provide any information to indicate whether any contamination outside of the glove box occurred as a result of this incident (Incident Report A0013).[131,132]

[130] Robinson, G.C., Internal Letter, *Re: Radiological Safety Incident Report, March 29, 1982.*
[131] Moore, J.D., Internal Letter. *Re: Quarterly Review of NMDF (T055) for Radiation Safety – First Calendar Quarter, 1983,* July 7, 1983.
[132] Badger, F.H., Internal Letter *Re: Radiological Safety Incident Report, February 8, 1983*.