

Site Summary – Building 4059

Site Identification:

Building 4059
Systems for Nuclear Auxiliary Power (SNAP) 8 Development Reactor (S8DR)
Large Leak Test Rig
Ground Prototype Test Facility
Includes Building 4759, Substation

Operational Use/History:

- Construction of Building 4059 began in 1961 and was completed in 1963.¹ As soon as the facility was finished, the facility was modified to accommodate the addition of a vacuum system. The installation of this system was completed in 1965.²
- Building 4059 was constructed to test the S8DR in vacuum conditions that simulated outer space.¹
- Testing of the S8DR began in 1968 and continued through 1969 when the program was terminated.³
- After termination, the reactor core and associated NaK systems were removed, the reactor cell pit was sealed, and the associated vacuum systems were mothballed.³
- In 1978, a decontamination and decommissioning (D&D) program was conducted to remove all contaminated or activated liquid and gas holdup tanks, associated piping, equipment from ground-level equipment rooms, all vacuum equipment components, and some of the ducting and sand shielding in the pipe chase room.³
- From 1987 to 1989, a D&D program was conducted to remove contamination from the below-ground vaults to prevent contamination from water leaking into the vault. Activities included scabbling the first layer of reinforcing concrete.⁴
- Following DOE approval, the above ground portions of Building 4059, as well as the remaining activated vault cells, were demolished in 2004.

Site Description:

- The S8DR facility is a 31-foot tall concrete and Butler-type structure with approximately 10,764 square feet of floor space. The below-ground test vault is 28 feet x 39 feet and 32 feet deep. Two test cells (north and south) are located at the west end of the vault.⁴
- Building 4059 was serviced by Substation 4759, which was removed in 2003.⁵

Relevant Site Information:

- There have been a number of incidents associated with Building 4059 involving activities that could have resulted in a release to the environment:
 - In 1969, S8DR fuel elements were found to be leaking hydrogen and fission products within the reactor core. A panel of experts was assembled to identify

Group M

the cause of the leak in order to correct the cause and to improve reactor design.⁶

- On February 12, 1970, an absolute filter on vacuum cleaner ruptured, contaminating the area (A0633).
- On February 19, 1970, while an employee was cutting a NaK pipe, a NaK fire broke out in the Pipe Chase Room. When employees smothered the fire with calcium carbonate, a dense cloud of white smoke filled the room. To prevent the spread of smoke, the room was sealed and inspections of the exhaust duct filters indicated that no airborne activity was released (A0576).
- On August 12, 1988, torch cutting in Pipe Chase Room resulted in contamination of employees. All employees and the Pipe Chase Room were successfully decontaminated (A0187).
- On April 6, 1989, an employee dropped an open box of filters while changing the exhaust system filters. This resulted in a cloud of contaminated dust, causing high airborne activity (A0197).
- On January 17, 1991, during a routine spot-check survey in the electrical room, chips of contaminated soil were found on the floor. It appeared that the soil had become contaminated when battery liquid had leaked on the floor. The soil was removed and disposed of as radioactive waste (A0212).
- On February 25, 1991, torching operation generated high airborne activity in adjoining high bay. All activities were halted until activity dropped to a safe level (A0214).
- On December 3, 1992, an employee dosimeter went off scale during D&D operations. Further investigation indicated that the employee had not actually received an unacceptable exposure (A0307).
- On December 22, 1998, it was found that contamination of fork truck and gloves was due to naturally occurring radon daughters (A0692).

Radiological Surveys:

- The facility was broken into two sections for surveys and release. Phase I consisted of the above-ground portion of the building, down to the basement level. Phase II consisted of the below-ground test vaults.
- In 1978, Rockwell International performed a radiological survey to provide an interim status of the D&D effort. The survey covered the building (except for the reactor chamber pit) and soil around excavations through soil samples, water samples, removable contamination smears and direct radiation measurements.³
 - The survey concluded that with the exception of the reactor chamber pit, pipe chase room and vacuum equipment room, the facility met the release criteria for unrestricted use.
 - Smear surveys conducted in the equipment rooms, support areas and the vacuum equipment room measured removable beta gamma contamination levels of <math><50 \text{ dpm}/100\text{cm}^2</math> (limit is

- removable beta-gamma contamination levels from 50 dpm/100cm² to 2,454 dpm/100cm² (limit is 1,000 dpm/100cm²).
- Total surface contamination measurements taken in the pipe chase room showed levels ranging from 125 mrad/hr to 5 rad/hr (limit is 0.1 mrad/hr). An earlier survey conducted in the reactor chamber pit found levels ranging from 25 mrad/hr to 168,000 mrad/hr (limit is 0.1 mrad/hr). All other areas of the facility had total surface contamination measurements of 0.05 mrad/hr compared to a background level of 0.03 mrad/hr (limit is 0.1 mrad/hr).
 - Water samples from the sand in the pipe chase room showed low levels of beta activity with a maximum of 1.1×10^{-6} μ Ci/ml. Groundwater samples showed less than 10^{-9} μ Ci/ml.
 - Soil samples collected during the excavation activities showed a maximum activity of 23 pCi/g compared to a natural activity of 20 pCi/g.
 - Concrete samples from the vacuum equipment room shield wall found activity less than 25 pCi/g.
- Oak Ridge Institute for Science and Education (ORISE) performed a radiological survey in 1995 to verify that Rockwell had adequately analyzed the radiological condition of the reactor vault. The survey covered only the vault through surface scans, surface activity levels, exposure rates, concrete samples and water samples.⁴
 - Surface scans identified areas of elevated gamma radioactivity on the floors and walls. Maximum areas were marked for further investigation.
 - Total surface activity ranged from 9,000 dpm/100cm² to 4,400,000 dpm/100cm² most likely as a result of activation products within the concrete matrix.
 - Exposure rates ranged from 0.7 mrad/hr to 5.5 mrad/hr.
 - Radionuclide concentrations in the concrete samples were:
 - Co-60, 0.4 to 3,580 pCi/g;
 - Co-58, <0.3 to 157 pCi/g;
 - Ba-133, <0.4 to 323 pCi/g;
 - Eu-152, <0.9 to 42,700 pCi/g;
 - Eu-154, <1.3 to 3,340 pCi/g; and
 - Eu-155, <0.5 to 35 pCi/g.
 - Radionuclide concentrations in water samples were: gross alpha, 3.6 to 28.3 pCi/L; gross beta, 8.4 to 21.5 pCi/L; and tritium, <750 to 924 pCi/L.
 - The survey concluded that Rockwell had accurately assessed the radiological condition of the vault if the residual contamination present in the pipe chase room was accounted for in the residual radioactivity (RESRAD) pathway analysis.
 - Boeing performed a final status survey of the Building 4059 Phase I area in 1999 to verify that the area met the release criteria for unrestricted use. The survey covered the Phase I area of Building 4059 through surface scans, a removable contamination survey and an ambient radiation survey.⁷
 - The maximum total activity found was 783 dpm/100cm² beta (limit is 5,000 dpm/100cm²).

Group M

- The maximum removable contamination found was 5.4 dpm/100cm² alpha (limit is 1,000 dpm/100cm²) and 54 dpm/100cm² beta (limit is 1,000 dpm/100cm²).
- The maximum adjusted ambient gamma exposure rate found was 4 µR/hr (limit is 5.0 µR/hr above background).
- The survey concluded that the Phase I area of Building 4059 met the release criteria for unrestricted use with no radiological restrictions.
- ORISE conducted a verification survey of Phase I of 4059 on October 26 through 28, 1999. The survey confirmed that the Phase I portion of the building met the release criteria for unrestricted use.⁸
- DHS conducted a verification survey of Phase I of 4059 in 1999. The survey confirmed that the Phase I portion of the building met the release criteria for unrestricted use.⁹
- The Environmental Protection Agency (EPA) conducted an oversight verification survey in 2001 for alpha, beta, beta-gamma radiation (total and removable) and gamma radiation.¹⁰ Surveys were performed to a quality level equal to a final status survey as defined by Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The contaminants of concern (COCs) for 4059 were mixed fission products, uranium, transuranic compounds and activation products on the floors walls and ceilings. EPA also collected 10 concrete core samples and four steel plate samples, which were analyzed for photon-emitting isotopes.
 - Three steel plate samples collected near the reactor cells showed the presence of activated Co-60.
 - Acceptable limits for the survey were consistent with Nuclear Regulatory Commission Regulatory Guide 1.86 and the proposed sitewide release criteria in the 1996 Boeing Area IV survey.
 - None of the field measurements indicated the presence of radionuclides above acceptable limits.
 - EPA field measurements confirmed the conclusions reached by both Rocketdyne and ORISE.
- In 2002, to prepare for the demolition of the building, samples were collected in the yard surrounding the building below the asphalt.¹¹ A total of 17 samples were collected and analyzed for gamma emitting radionuclides. No samples had any detection of man-made radionuclides.
- In 2003, after excavation of the asphalt surrounding Building 4059, 15 soil samples were collected and analyzed for the complete suite of radionuclides.¹² All levels are below the site DCGLs.
 - One sample had detectable H-3 at 11.8 pCi/g; all others were non-detect.
 - One sample had detectable Cs-137 at 0.44 pCi/g; all others were non-detect.
 - One sample had detectable Eu-152 at 0.84 pCi/g; all others were non-detect.
 - All other man-made radionuclides, including Fe-55, Co-60, Ni-63, Sr-90, Eu-154, Pu-238, Pu-239, Pu-241 and Am-241 were non-detect.
 - Uranium and Thorium isotopes were at background levels.

- In September 2004, Boeing conducted a MARSSIM based survey and sampling project in the excavation at Site 4059 following removal of the building basement and foundations.¹³
 - Thirty-four samples were taken. None of the field measurements indicated the presence of radionuclides above acceptable limits (derived concentration guideline levels (DCGLs)).
 - Co-60, Eu-152, Cs-137 and Sr-90 were all non-detect.
 - Uranium and thorium were at background levels.
 - About half the samples had detectable Ni-63 that was less than the DCGLs and EPA 10^{-6} PRG levels.
 - Several samples had detectable quantities of H-3, Am-241, and Pu-239 that were less than DCGLs and EPA 10^{-6} PRG levels.
- In October 2004, ORISE conducted an independent verification survey of the 4059 excavation.¹⁴
 - Ba-133 is reported at -0.01 to 0.02 pCi/g.
 - Co-60 is reported at -0.02 to 0.05 pCi/g.
 - Cs-137 is reported at -0.03 to 0.00 pCi/g. Eu-152 is reported at -0.04 to 0.06 pCi/g.
 - Eu-154 is reported at -0.07 to 0.08 pCi/g.
 - H-3 is reported at -0.7 to 5.1 pCi/g.
 - Exposure rate ranged from 9 to 16 μ R/hr.
- In October 2004, DHS conducted verification sampling of the 4059 excavation. Results were not yet available as of February 2005.

Status:

- Following DOE approval, the above ground portions of Building 4059, as well as the remaining activated vault cells, were demolished in 2004.

References:

- 1- Boeing Internal Website, <http://rdweb/shea/radiationsafety/>, accessed August 2003.
- 2- Atomics International Internal Report, no document number, "Ground Prototype Test facility: Building 059 Facility Handbook," no date given.
- 3- Rockwell International Document, N704TI990043, "Radiological Survey Results – Interim Status, Building 059, SSFL," November 28, 1978.
- 4- ORISE Report, "Radiological Survey of the Building 059 Reactor Vault, Santa Susana Field Laboratory, Rockwell International, Ventura County, California," June 1995.
- 5- U.S. EPA Report, "Final Oversight Verification and Confirmation Radiological Survey Report for Building T-059," December 20, 2002.
- 6- United States Atomic Energy Commission, Untitled letter, from M. Klein (AEC) to J. J. Flaherty (Atomics International). October 29, 1969.
- 7- Boeing Report, RS-00008, "Building 4059, Final Status Survey Report (Phase I)," September 11, 1999.

Group M

- 8- SSFL Area IV, ETEC Industrial Planning Maps, 1962-1992.
- 9- ORISE Report, 2000-1523, "Verification Survey of Building 4059 (Phase I), Santa Susana Field Laboratory. The Boeing Company. Ventura County, California," December 2000.
- 10- Personnel Interview, Dan Trippeda, September 12, 2003.
- 11- Boeing Document, RD02-148-01, "Site Environmental Report for Calendar Year 2002 DOE Operations at The Boeing Company, Rocketdyne Propulsion & Power," September 2003.
- 12- Boeing Document, RD04-170, "Site Environmental Report for Calendar Year 2003 DOE Operations at The Boeing Company, Rocketdyne Propulsion & Power," September 2004.
- 13- Personal Interview, Phil Rutherford, January 2005.
- 14- Draft ORISE Report. "Verification Survey of the Building 4059 Excavation, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California." January 2005.
- 15- Historical Site Photographs from Boeing Database.

Photograph – Building 4059



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Site Summary – Building 4459

Site Identification:

Building 4459
Building 4459 Uninterruptible Power Supply (UPS)
Energy Technology Engineering Center (ETEC) Storage

Operational Use/History:

- Constructed in 1963.
- Building 4459 was listed as a UPS.¹
- Building 4459 contained a large diesel generator and flywheel, which, in combination, were designed to function as a fail-proof back-up power source.²
- By 1992, Building 4459 was being used for non-radiological storage.³
- Demolished in 2003.

Site Description:

- Building 4459 was an 800-square-foot storage building. The frame, siding and roof were constructed of steel.¹
- Building 4459 was located directly northwest of 4059, at the western edge of Area IV.

Relevant Site Information:

- There are no Use Authorizations and no Incident Reports associated with Building 4459.⁴

Radiological Surveys:

- Boeing, ORISE and DHS each performed radiological surveys of Building 4459 in conjunction with their surveys of Building 4059. The surveys confirmed that Building 4459 met the release criteria for unrestricted use.^{5,6}

Status:

- Building 4459 was demolished in 2003.

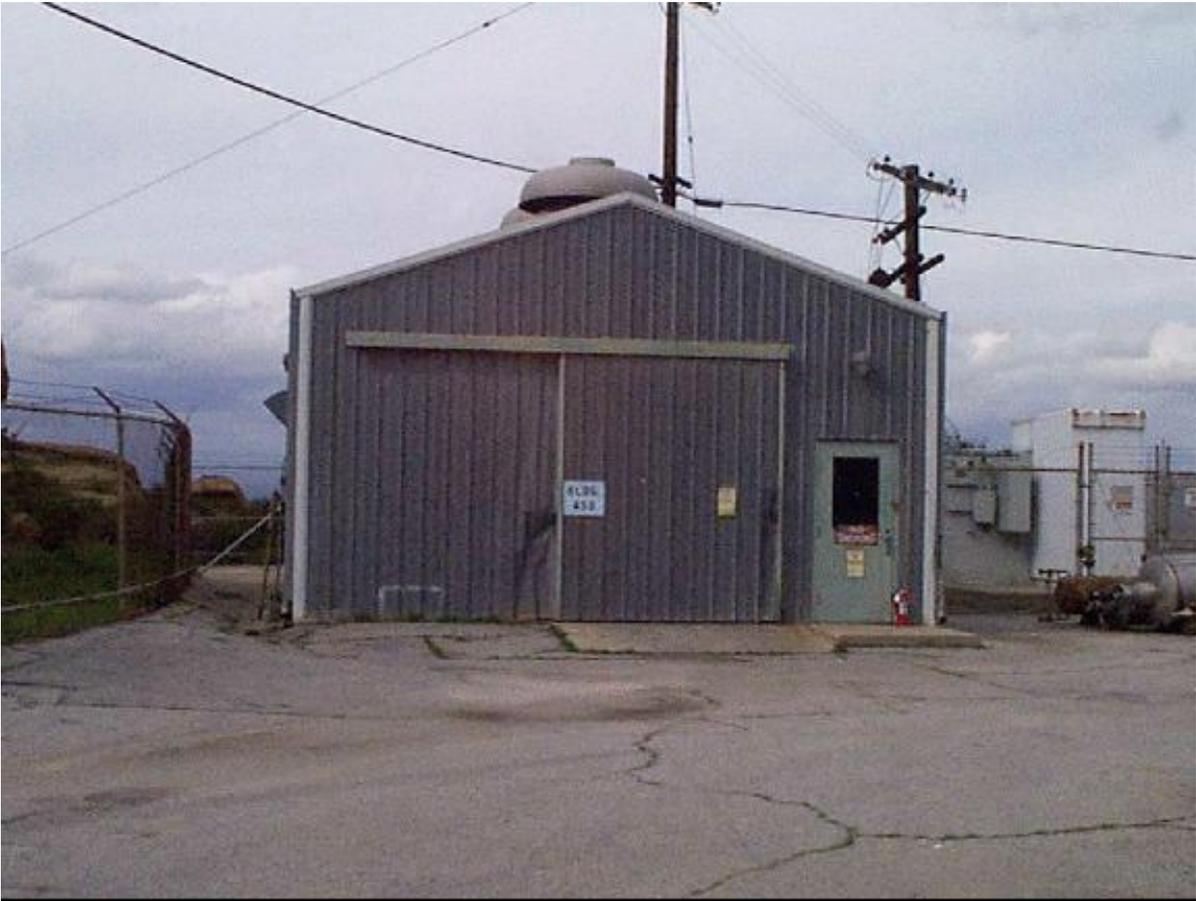
References:

- 1- U.S. Energy Research and Development Administration Liquid Metal Engineer Center Document, LR-03026, Part 1, "Site Development Plan 1977-1981, Volume 1," June 1975.
- 2- Personnel Interview, Randy Ingersoll, September 23, 2003.
- 3- SSFL Area IV, ETEC Industrial Planning Maps, 1962-1992.

Group M

- 4- Historical Site Photographs from Boeing Database.
- 5- Review of Radiation Safety Records Management System, 2003.
- 6- Boeing Report, RS-00008, "Building 4059, Final Status Survey Report (Phase I)," September 1999.
- 7- ORISE Report, 2000-1523, "Verification Survey of Building 4059 (Phase I), Santa Susana Field Laboratory. The Boeing Company. Ventura County, California," December 2000.

Photograph – Building 4459



Legend

Labeled Features:

(Based on SSFL Documents
as of October 2004)

 Buildings/Sites:
"Current"

 Buildings/Sites:
"Demolished"

Unlabeled Features:

 Leachfield
(Removed)

 Tree

 Rock

 Concrete Curb

 Gutter

 Asphalt/Concrete
Berm & Paving

 Sidewalk

 Dirt Road

 Fence

 Stream/Pond

 Drain

 Area IV Boundary