Site Summary – Building 4010

Site Identification:

Building 4010
Systems for Nuclear Auxiliary Power (SNAP) 8 Experimental Reactor (S8ER) Facility
Includes Site 4807, Electrical Equipment Pad
Includes Site 4808, Electrical Equipment Pad
Includes Site 4809, Air Blast Heat Exchanger Pad

Operational Use/History:

- Constructed in 1959.
- Building 4010 was used for the 50 kWt SNAP 2 Experimental Reactor test. After completion of the SNAP 2 test on November 19, 1960, the reactor and associated test equipment were removed from the building.[1]
- In 1961, modifications were made to allow the safe operation of the facility with the S8ER. Tests of the S8ER began in 1963 and following completion of the SNAP 8 tests on April 15, 1965, the reactor and associated test equipment were removed from the building.[1]
- In 1974, the S8ER was declared excess to the government's needs.[2]
- In September 1977, removal of all radioactive materials began. Activities included removing the reactor containment vessel and razing the building.[2]
- Demolished in 1978 after decontamination.[3]

Site Description:

- Building 4010 was a rigid, steel-framed structure with corrugated metal siding and roofing. It was 60 feet long by 24 feet wide, with 17-foot ceilings.[2]
- The subsurface structure of Building 4010 was at least 14 feet below grade. This structure contained three steel reinforced concrete vaults, two of which were lined with steel.[2]
    - The primary containment vessel consisted of a 38-inch diameter by 15.5-foot high carbon steel pressure vessel embedded in concrete ranging from 18 to 27 inches thick.[4]
    - The primary system vault consisted of a carbon steel vault liner embedded in concrete. Removable shield plugs covered the top.[2]
    - The secondary equipment pit was a small, unlined concrete vault. All passageways to the primary vault were welded shut to prevent exposure.[2]
- The amount of radioactive waste produced by test reactor operations was minimal, so major waste collection and processing systems were not included in Building 4010.[2]

- The building was surrounded by several small concrete pads (Site 4807, Site 4808 and Site 4809) that were initially labeled separately, but were absorbed by the 4010 footprint by 1964.

Relevant Site Information:

- The change room was connected to a septic tank and leach field located west of Building 4010 until 1961, when the central sanitary sewer system became available.[1]
- Building 4010 was eventually abandoned in place; it was later removed.[5]
- The entire vault complex was provided with a sub-foundation drainage system consisting of circuits of perforated metal pipe surrounded by gravel fill. The system drained into a pipe well sump at the east end of the building. From the sump, water was pumped into a tank for controlled disposal if contaminated, or released to the surface drainage system if it tested clean.[1]
- Three incidents occurred in Building 4010 that could have resulted in a release to the environment:
    - On April 30, 1961, it is known that an incident occurred, however, no details of the incident could be found. Incident Report A0598, dated June 27, 1961 referenced the April incident, but only indicated that the processing of samples from the April incident would be delayed (A0598).
    - On January 1, 1964, fission product was released to the cover gas and NaK coolant as a result of cladding failure of SNAP-8 reactor fuel (A0277).
    - On October 19, 1965, cutting of the control drum drive rods resulted in Co-60, Mn-54 and Fe-59 contamination in the high bay area. The level of contamination was found to be 200 mrad/hr, including 100 mR/hr due to gamma. The contamination was cleaned and no workers received an unacceptable exposure (A0349).

Radiological Surveys:

- Guide limits for the cleanup were as follows:[6]
    - Beta-gamma emitters:
        - 0.1 mrad/hr at 1 cm total.
        - 1000 dpm/100 cm^2 removable.
    - Alpha emitters:
        - 100 dpm/100 cm^2 total.
        - 20 dpm/100 cm^2 removable.
    - Activated soil:
        - As close to background as practicable, but not greater than 100 pCi/g gross detectable beta activity.
- Prior to demolition, Atomics International personnel conducted a survey to determine the level of radioactivity in activated structures within Building 4010.[4]

  - The principal nuclides in the reactor containment vessel and cooling coils were Mn-54 and Fe-55. The total specific activity of these contaminants was 5.1 x 10^{1} µCi/gm and the total activity was 3.6 x 10^{7} µCi.
  - The principal nuclides in the reinforcing rods were Mn-54 and Fe-55. The total specific activity of these contaminants was 5.1 x 10^{2} µCi/gm and the total activity was 3.1 x 10^{7} µCi.
  - The principal nuclides in ordinary concrete were tritium, Ar-39, Ca-41, Fe-55, Co-60 and C-14. The total specific activity of these contaminants was 8.7 x 10^{2} µCi/gm and the total activity was 3.8 x 10^{8} µCi.
  - The principal nuclide in high-density concrete was Fe-55. The maximum specific activity of this contaminant was 2.2 x 10^{2} µCi/gm.
  - The principal nuclide in the thermobestos insulation was Ca-41. The specific activity of this contaminant was 5.5 x 10^{-1} µCi/gm of insulation.
  - The principal nuclide in silver braze of the shielding was Ag-108. The maximum specific activity of this contaminant was 1.4 x 10^{4} µCi/gm.
  - The principal nuclides in stainless steel of the shield were Mn-54 with specific activity level of 1.9 x 10^{-1} µCi/gm, Fe-55 with a specific activity level of 3.2 x 10^{1} µCi/gm, Ni-63 with a specific activity level of 1.7 x 10^{1} µCi/gm and Co-60 with a specific activity level 5.6 x 10^{1}µCi/gm.
  - The principal nuclides in stainless steel of the instruments in the reactor vessel thimbles were Mn-54 with a specific activity level of 6.8 x 10^{-2} µCi/gm, Fe-55 with a specific activity level of 1.1 x 10^{1} µCi/gm, Ni-63 with a specific activity level of 6.1 x 10^{0} µCi/gm and Co-60 with a specific activity level of 2.1 x 10^{1} µCi/gm.
    - A radiation measurement taken in the reactor vault indicated maximum radiation levels of 120 R/hr. The activated stainless steel in the thimbles was thought to be the source of this reading.

- During dismantlement and excavation activities, water and air samples were collected to assure the safety of workers and to monitor the discharge of effluents.[2]
  - None of the water samples indicated concentrations greater than 4.5 x 10^{-8} µCi/ml beta—well below the limit of 3 x 10^{-7} µCi/ml for Sr-90.
  - None of the air samples indicated radioactive particulate concentrations exceeding 10^{-11} µCi/ml beta, other than naturally occurring airborne radioactivity. The limit for Co-60 is 3x10^{-10} µCi/ml.
- Following demolition in 1977-1978, Atomics International personnel conducted a radiological survey to verify that remediation attained accepted cleanup levels to support unrestricted release.[5]
  - Approximately 200 smears for removable contamination were taken on concrete, piping and steel.
    - No smears were found to exceed 50 dpm/100 cm^{2} for beta.
    - Alpha contamination was not expected in this area, and none was detected.

  - In a complete walk-through survey, the maximum surface contamination detected was 0.05 mrad/hr. Average background is 0.04 mrad/hr. All readings were below the 0.1 mrad/hr limit.
  - Prior to backfilling, concrete samples were taken from a portion of a vault wall. All samples were less than 50 pCi/g gross beta. [All clean concrete was used as backfill for ditch repair between Area 1 and Area 2.]
  - Soil samples were collected in the area after the excavation was filled with clean backfill. All samples were less than 50 pCi/g gross beta.
  - During the dismantling of the sump drain system and vessel pit, water samples were collected and no samples exceeded 4.5×10^{-8} µCi/cc, below the limit of 3×10^{-7} µCi/cc for Sr-90.
- In September of 1979, the Formerly Utilized Sites Remedial Action Program (FUSRAP) Survey Group from Argonne National Laboratory conducted a certification survey to ensure that the facility met unrestricted release criteria. At the time of the survey, the building had already been demolished and the asphalt parking area was already in place.[6]
  - The survey included a walkover, soil borings through the asphalt and soil coring.
    - The walkover survey indicated some elevated reading on the asphalt pad, ranging from 15-30 µR/hr (natural background is 9-15 µR/hr).
      - Further investigation revealed that elevated reading were most likely a result of radioactive materials stored on the hill to the east (Radioactive Material Handling Facility (RMHF)).
    - The soil borings indicated that no U-235 or U-238 were present. Other nuclides were found in the following ranges:
      - Cs-137 from 0.00 ± 0.00 pCi/g to 0.42 ± 0.03 pCi/g;
      - Th-232 from 0.147 ± 0.23 pCi/g to 2.27 ± 0.16 pCi/g;
      - Ra-226 from 0.358 ± 0.081 pCi/g to 3.46 ± 0.24 pCi/g;
      - Co-60 from <0.03 pCi/g to 7.32 ± 0.07 pCi/g.
- In November of 1979 and October of 1981, the FUSRAP Survey Group from Argonne National Laboratory revisited Building 4010 to conduct a certification survey to ensure that the facility continued to meet unrestricted release criteria. At the time of the survey, the building had already been demolished and the asphalt parking area was already in place.[7]
  - The survey confirmed the results of the previous Argonne survey, and the following conclusions were developed:
    - The Co-60 found in soil was well below the criteria set by the Department of Energy (DOE) for the site.
    - Gamma background readings at the surface were influenced by shine from the RMHF. The Co-60 found in soil was not believed to contribute to the total background readings.
    - The site met the criteria for an unrestricted release.

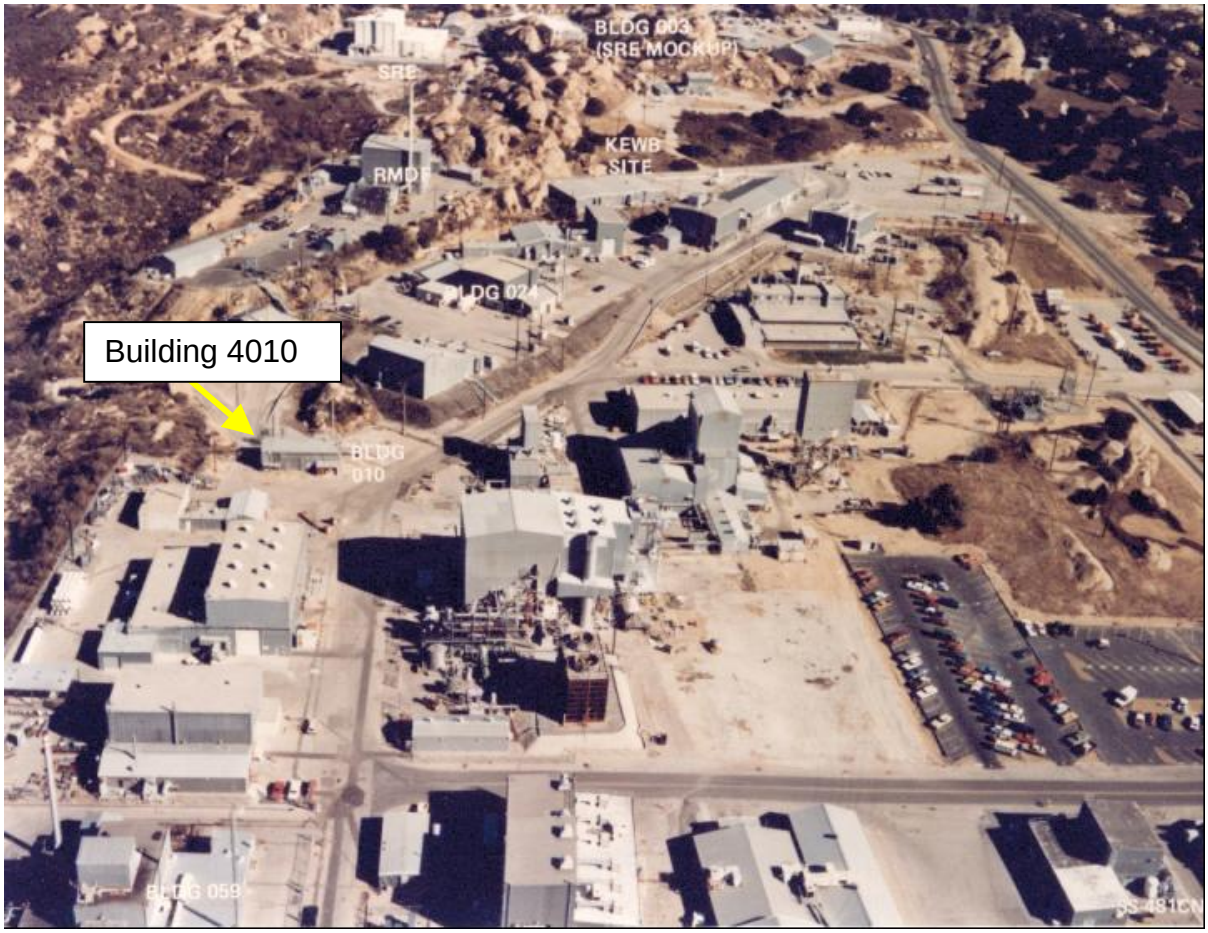
Status:

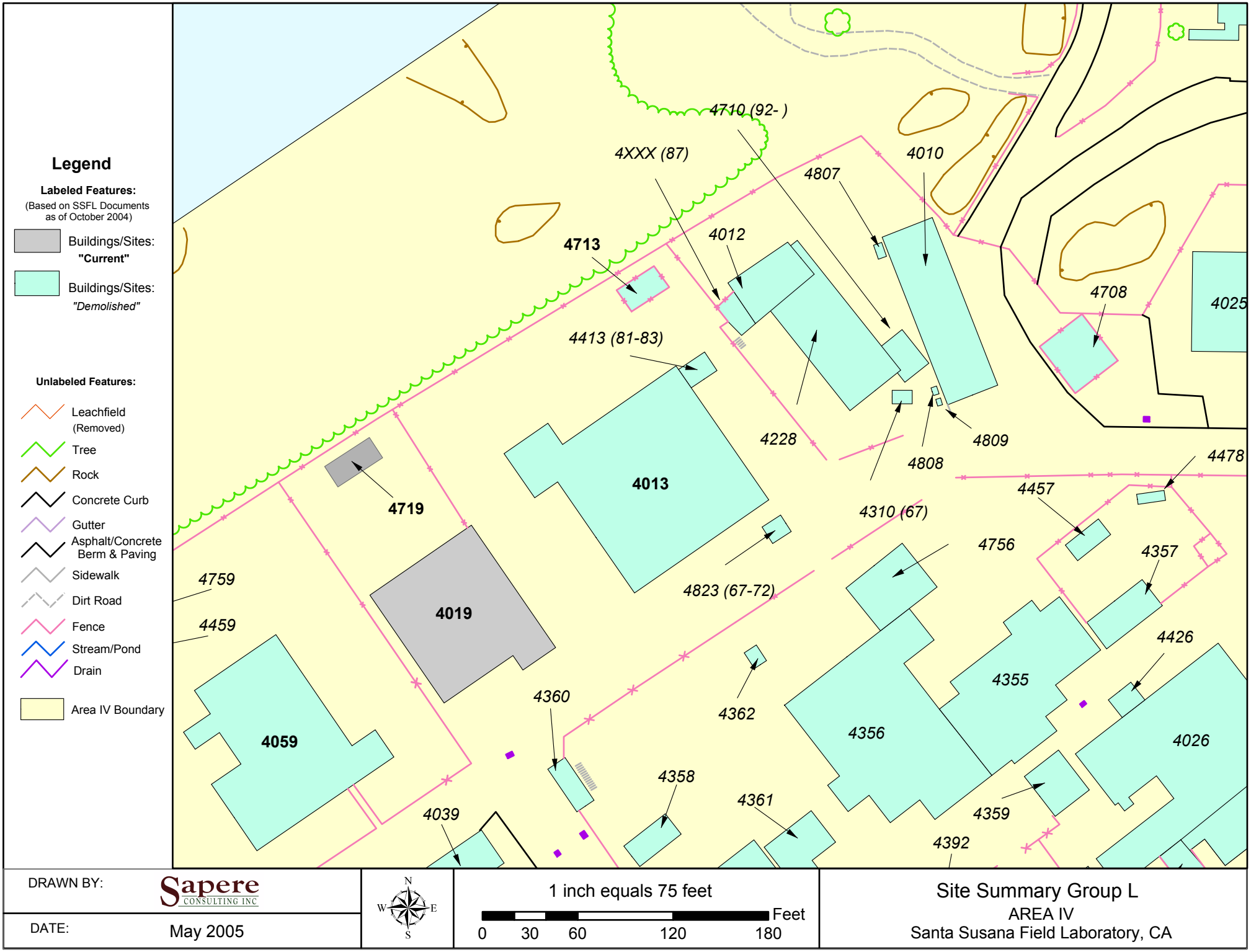
- DOE released Building 4010 for unrestricted use December 12, 1982.[8]
- Building 4010 was decontaminated and demolished in 1977-1978.
- Following demolition, an asphalt parking lot was built where the Building 4010 once stood.[2]

References:

1- Rockwell International Document, N704FDP990005, "Facilities Dismantling Plan for Building 010 (S8ER)," December 10, 1976.
2- Rockwell International Document, ESG-DOE-13237, "S8ER Facilities Decommissioning Final Report," February 28, 1979.
3- Rockwell International Document, Use Authorization No. 111, "Decontamination and Disposition of Building 010," January 16, 1978.
4- Atomics International Document, SA-652-130-002, "Determination of Levels of Radioactivity and Significant Radionuclides Present in Neutron-Activated Structures in Building T010," June 28, 1973.
5- Rockwell International Document, N704TI990041, "Radiological Survey Results—Release to Unrestricted Use, Building 010 at SSFL," August 28, 1978.
6- Argonne National Laboratory Report, no document number, "Certification Survey of the SNAP 8 Experimental Reactor (S8ER) Facility in Building 10, Santa Susana Field Laboratories of the Energy Systems Group of Rockwell International at Santa Susana, California," September 1979.
7- Argonne National Laboratory Report, no document number, "Interim Post Remedial Action Survey Report for Systems for Nuclear Auxiliary Power-8 (SNAP-8) Experimental Reactor Facility (Building 010), Santa Susana Field Laboratory, Rockwell International, Canoga Park, California," May 1983.
8- Rockwell International, Letter #2726, "S8ER Facilities Decommissioning Final Report Number ESG-DOE-13237," from Len Lanni (DOE) to C. C. Connors (Atomics International), December 15, 1982.
9- Historical Site Photographs from Boeing Database.
10- SSFL Area IV, ETEC Industrial Planning Maps, 1962-1992.

Photograph – Building 4010




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
4710 (92-)
4XXX (87)
4010
4807
4012
4713
4708
4025
4413 (81-83)
4228
4809
4808
4478
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4310 (67)
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May 2005
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1 inch equals 75 feet
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Feet
Site Summary Group L
AREA IV
Santa Susana Field Laboratory, CA