Appendix A – SSFL Area IV General Chemical Use Overview

Exposure Unit ID	RFI SWMU/AOC ID	RFI SWMU/AOC Description	General Areas and Chemical Uses
EU-09	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4374 • Used for non-nuclear liquid metal heat transfer loops testing (1956-1996) • Chemical usage: solvents and metals
EU-09	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4383 (Instrumentation Building and Assembly and Testing Building) and Leach Field (AI-Z10) • Liquid Metal Engineering Center Assembly and Testing and Construction Staging • Leach field received sanitary waste from bldg.; removed in 2000 • Chemical usage: VOCs and metals • Vertical extent of elevated metals concentrations in soil (leach field) from previous sampling not defined
EU-09	Area IV AOC	DOE Leach Fields 3 [DOE]	Substation and Transformer Areas • Substations: 4707, 4755, 4883A, 4883B, Pole A324 (three pole-mounted transformers near southeastern corner of Bldg. 4373 Leach Field) • Chemical usage: PCBs
EU-09	Area IV AOC	DOE Leach Fields 3 [DOE]	USTs • UT-12/UT-55 (TPH) [removed in 1986], UT-72 (TPH and mercury) [removed in 1999] • Mercury detected at elevated concentrations in surrounding soil during UT-72 removal; lateral extent of TPH contamination (up to 14,000 mg/kg in 1995) at UT-12 not defined
EU-09	Area IV AOC	DOE Unaffiliated Features [DOE]	Buildings 4461 (Sodium Pump Test Facility Motor Generator Building), 4463 (Sodium Cleaning and Handling Facility), 4628, and 4662 • Includes Substations 4760A, 4760B, and 4762 • Chemical usage: solvents, TPH, PCBs, and metals
EU-10	SWMU 7.1	Building 4056 Landfill [DOE]	Building 4056 Landfill and Southern Debris Area • Landfill created in early 1960s; covered in 1969 • 89 drums removed from top of landfill in 1980/1981; drums contained oils, alcohols, sodium and sodium reaction products, grease, phosphoric acid, and asbestos. • Soil samples taken showed O&G up to 1,100 mg/kg • Well RD-7 installed south of the landfill in 1985 showed 130 ppb TCE
EU-10	SWMU 7.1	Building 4056 Landfill [DOE]	B056 Excavation Debris Area
EU-10	SWMU 7.1	Building 4056 Landfill [DOE]	B100 Discharge Area

Appendix A – SSFL Area IV General Chemical Use Overview

Exposure Unit ID	RFI SWMU/AOC ID	RFI SWMU/AOC Description	General Areas and Chemical Uses
EU-10	SWMU 7.5	Building 4100 Trench [DOE]	<u>Building 100 Trench Disposal Area</u> • Consisted of three elongated pits (60-100 ft long x 20-40 ft wide x 2-6 ft deep); overall area measures 100 ft x 100 ft • Extensive scrap metal, asbestos-containing materials, charred wood, and ash were found in the trench and were removed during on-site investigation activities in 1999/2000 • Western portion of trench site identified as potential upgradient source area for dioxins in soil and surface water (NPDES Outfall 007) • VOCs have been detected in cross-gradient and downgradient near-surface groundwater wells; source is believed to be SNAP site area
EU-10	SWMU 7.5	Building 4100 Trench [DOE]	<u>Building 100 Advanced Epithermal Thorium Reactor (AETR) and Fast Critical Experiment Lab (FCEL)</u> • Constructed in 1960; still present on-site • Twenty different reactor core configs. (thorium and uranium-fueled) studied in Bldg. 100; reactor tests with high-energy (fast) neutrons conducted at the FCEL; program stopped in 1974 • Decontaminated and decommissioned for unrestricted use in 1980 • High bay currently used as a high-energy Computer Aided Tomography (CAT) facility • Labs are used by Radiation Safety for radioactive sample counting and instrument calibration • Dioxins were detected in shallow soil west of Bldg. 100 and in stormwater at NPDES Outfall 007 • Bldg. 100 Discharge Area identified as potential source for VOCs in well RD-91 (Chatsworth)
EU-10	SWMU 7.5	Building 4100 Trench [DOE]	<u>Building 4100 Leach Field</u> • Located east of Bldg. 4100; received sanitary sewage from Bldg. 4100 • Excavation activities in 2001 indicated the septic system had previously been removed
EU-10	SWMU 7.5	Building 4100 Trench [DOE]	<u>Hummocky Areas (Northern and Western)</u> • Metals exceed background levels and ecological RBSLs in southern portion of Western Hummocky Area; background level exceedances observed to date have been attributed to shale on-site

Appendix A – SSFL Area IV General Chemical Use Overview

Exposure Unit ID	RFI SWMU/AOC ID	RFI SWMU/AOC Description	General Areas and Chemical Uses
EU-11	SWMU 7.3	Building 4886 Former Sodium Disposal Facility (FSDF) [DOE]	South of Former Disposal Area • Facility used for treatment of residual Na and Na/K on equipment by reactions with water • Site included two disposal ponds, a western debris area, and a concrete pool used for treatment; areas were excavated to bedrock and backfilled with clean soil • Site also included a steam lance, one channel debris area, and a former pistol range • Chemical usage: solvents, kerosene, hydrocarbons, PCBs/terphenyls, Na, and Na/K
EU-11	SWMU 7.3	Building 4886 Former Sodium Disposal Facility (FSDF) [DOE]	Former Drum Debris Area
EU-11	SWMU 7.3	Building 4886 Former Sodium Disposal Facility (FSDF) [DOE]	FSDF Pistol Range
EU-11	Area IV AOC	Building 4009 Leach Field	• Bldg. 4009 contained two nuclear facilities, an organic modulated reactor (OMR), and a sodium graphite reactor (SGR) • Solar concentrator facility located to the south • Leach field (AI-Z11) received discharge of sanitary wastes prior to 1961 and operational liquids prior to 1967 • Chemical usage: terphenyls, PCBs, kerosene, diesel, solvents, Na, and Al
EU-12	Area IV AOC	Pond Dredge Area [Boeing]	Pond Dredge Area • Used in the 1960s to place pond dredge materials from the Silvernale Reservoir and the R-2 Ponds • Characterized by hummocky terrain that may include piles of pond dredge and construction debris. • Site may contain a depleted uranium slug that was dropped from a helicopter • Previous sampling detected metals at concentrations above screening levels
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4353 (Organics Reactor Development Building / Diffusion Coating Experiment Building / Hypersonic Flow Test Facility) and Leach Field (AI-Z15) • Used for sodium mass transfer studies during the 1960s, reactor research and development, and explosives storage • Leach field received sanitary waste from bldg.; removed in 2001 • Chemical usage: energetics and perchlorate • Vertical extent of elevated metals concentrations in soil (leach field) from previous sampling not defined

Appendix A – SSFL Area IV General Chemical Use Overview

Exposure Unit ID	RFI SWMU/AOC ID	RFI SWMU/AOC Description	General Areas and Chemical Uses
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4363 (Mechanical Component Development and Counting Building) and Leach Field (AI-Z14) • Used as a metallurgical research and development laboratory for examination of post-test SRE components between 1957 and 1963; used for storage after 1963 • Leach field received sanitary waste from bldg.; removed in 2002 • Contamination resulting from work on a contaminated sodium component from the SRE Core I accident (1959; uranium and mixed fission products) • Chemical usage: solvents, kerosene, tetralin, naphthalene, metals, and NaK • Vertical extent of elevated metals concentrations in soil (leach field) from previous sampling not defined
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4373 and Leach Field (AI-Z13) • Used to manufacture high-energy rocket fuels, test large rocket engines (1954-1956), and conduct SNAP reactor criticality tests (1957-1963); used as a sodium heat transfer facility in 1960 and storage of heat transfer equipment after 1964 • Pump Bearing Facility – used for proof and performance testing of sodium lubricated bearings for the Liquid Metal Fast Breeder Reactor prototype pumps and main heat transfer pumps of the Fast Flux Test • Leach field received sanitary waste from bldg.; removed in 2000 • Chemical usage: solvents, TPH, metals (incl. Be, Hg, Na), perchlorate, and propellants • Previous sampling detected metals at concentrations above screening levels
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Buildings 4375, 4874, and 4875 • Used for testing SNAP control rod assemblies for the Piqua Organic Moderated Reactor (OMR) from late 1950s to approx. 1968; later used for barrel storage (unknown contents)
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4473 (Hydraulic Test Instrumentation Facility) • Used for hydraulic testing of pipes, pumps, and other loop components
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4854 (Radiation Fuel Gauge Test Structure)
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4863 (Hydraulic Test Loop) • Used for hydraulic testing of pipes, pumps, and other loop components

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Exposure Unit ID	RFI SWMU/AOC ID	RFI SWMU/AOC Description	General Areas and Chemical Uses
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Building 4873 (Fuel Rod Test Tower [1967] and Hydraulic Test Laboratory)
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	Substation Areas • Substation: 4853 • Chemical usage: PCBs
EU-12	Area IV AOC	DOE Leach Fields 3 [DOE]	USTs • UT-75 (TPH and VOCs) [removed in 2001], UST north of Bldg. 4363 (fuel oil)

Appendix A – SSFL Area IV General Chemical Use Overview

Exposure Unit ID	RFI SWMU/AOC ID	RFI SWMU/AOC Description	General Areas and Chemical Uses
EU-13	SWMU 7.9	Empire State Atomic Development Authority (ESADA) Chemical Storage Yard [Boeing]	• Sodium-water tests were conducted (1964-1968) at Bldg. 4814 (removed in 1991), a large leak injector device (LLID), where heated sodium, high-pressure water, and steamed flowed via tubes and piping to a test section to simulate tube failure in a sodium graphite reactor (SGR) • Prior to its use as a practice shooting range, the former ESADA Pistol Range was used for testing zirconium hydride (ZrH_2) covered surrogate pellets at the Isotope Impact Test Device (Bldg. 4820) from 1966-1973 • A former pistol range was constructed in the southeastern portion of the site in an area formerly used for surrogate fuel pellet testing where shot gun and hand gun rounds were fired at targets placed in front of an earthen berm; pistol range operations ceased in 1995; approx. 8,500 pounds of lead shot were used at the ESADA Pistol Range during 1980-1995 • A portion of the ESADA Former Storage Yard (the southern storage area) was used for storage (1970s – 1983) of more than 500 drums containing Dowanol glycol ethers/ethanol and empty drums; over 400 of the drums contained denatured ethanol, some of which were known to have leaked, and approx. 120 drums contained Dowanol PM (propylene glycol methyl ether), which was nearly saturated with sodium • Approx. 100 empty drums were located in the northern storage area, which were removed in 1983 • Two horizontal ASTs were removed from the northern portion of the ESADA site; one of the tanks (AT-15) was an 8,000-gallon stainless steel former Process Development Unit tank that had contained “green liquor” containing organic compounds, sulfur compounds, and ash • Soil samples collected in 1988 at the site did not indicate any levels exceeding federal or state standards; however, subsequent RFI sampling detected metals (e.g., aluminum, antimony, arsenic, and lead) at concentrations above screening levels • A groundwater well was installed but was too dry to yield any samples

Appendix B

Historical Site Assessment Summary

Appendix B
Historical Site Assessment Summary

The document entitled *Historical Site Assessment of Area IV, Santa Susana Field Laboratory, Ventura County, California*, was prepared by Sapere Consulting, Inc. and Boeing for DOE in 2005. This HSA focused only on radionuclide contamination and was developed to summarize the operational history of Area IV for both the DOE and Boeing from a radiological perspective. The purpose was to identify areas of radiological operations, compile information on prior radiological cleanups and releases and to identify further actions needed to ensure that the radiological cleanup of Area IV is completed.

The DOE and Boeing evaluated 272 numbered structures (collectively referred to as "sites") and any other areas of radionuclide contamination that existed in Area IV since its establishment in 1953. This was to ensure all areas where any types of operations were performed in Area IV were evaluated for radiological impact. To evaluate each site, a site summary was prepared using operational records, incident reports, site maps, decommissioning reports and personnel interviews. The site summaries include information about historical and current use and information about the management and use of regulated radiological materials at the site. Based on the information presented in the site summaries, all sites were classified either as radiologically-impacted or non-impacted. Sites that had any indication of management or use of regulated radiological material were classified as impacted. A summary of the information contained in the site summaries is contained in this appendix.

The information contained in the this appendix was used as a basis for developing the process knowledge for classifying various areas of Area IV as Class 1, Class 2, and Class 3 as defined by MARSSIM. Although Boeing and DOE concluded that some portions of Area IV were non-impacted, the approach used here was to assume that all portions of Area IV were impacted and are Class 3 at a minimum. The classifications assigned to different regions of Area IV in the HSA were not used as a basis for assigning classifications in this data gap analysis.

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4113	No	4511	A	EU-01	See 4511	None
4114	No		A	EU-01	Decontamination trailer designed for but not used as a RAD Decon station for personnel involved in an accident.	None
4313	No	the OCY	A	EU-01	See OCY	
4511	No		A	EU-01	Site 4511 Parking Lot At Main Gate, Includes Building 4113, Guard Shack; Includes Building 4623, Guard Shack; Constructed prior to 1962, Site 4511 served as a parking lot for personnel working in the Old Conservation Yard (OCY) and adjacent areas. The parking lot is no longer in use. There are no Use Authorizations and no Incident Reports associated with Parking Lot 4511. A radiological survey of the Old Energy Systems Group (ESG) Salvage Yard (Old), Rocketdyne Barrel Storage/Conservation Yard and New Salvage Yard was conducted in 1988. Scope/ Purpose: In 1988, the ESG Salvage Yard (also known as the OCY), Barrel Storage/Conservation Yard and former location of 4113 were surveyed for fixed and removable alpha/beta contamination. Ambient gamma exposure rate measurements were taken in the Storage Yards. Soil samples were collected because radioactivity was indicated by exposure rate measurements in the southwest corner of the Barrel Storage/ Conservation Yard. Background: 15 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. Average Ambient Gamma: 14.3 µR/hr. Survey results were below the acceptable limits.	None
4623	No	4511	A	EU-01	See 4511	None
Old Conservation Yard (OCY)	Yes		A	EU-01	Supported research & development and nuclear related work; materials storage yard for Plant Services Dept; parking area for trailers & other vehicles; Radioactive materials not deliberately dumped or placed in area; Radioactive spill from leaking barrels in 1976; Contaminated soil, asphalt, barrels, pallets removed; area cleaned and surveyed; mixed fission products believed to be contaminant; Rad survey found potential contamination; soil samples collected found average Cs-137 concentration at 81 pCi/g above DCGL of 60.3 pCi/g; site remediated, additional soil samples showed Cs-137 concentration now 13.1 pCi/g; during 1993 final verification survey, composite soil sample indicated Cs-137 (0.6 pCi/g), non-detect for Sr-90 and 1.4 pCi/g for U-238. 2002 twenty-seven soil samples ranged from non-detect to 2.7 pCi/g (gross Cs-137).	Cs-137, U-238, Sr-90
4320	No		C	EU-01	Fuel Oil Control/Pump Building; no Use Authorizations or Incident Reports associated with building.	None
4731	No		C	EU-01	Fuel Oil Storage Tank; no Use Authorizations or Incident Reports associated with building.	None
4732	No		C	EU-01	Fuel Oil Storage Tank; no Use Authorizations or Incident Reports associated with building.	None
4583-Old ESG Storage Yard	Yes		C	EU-01	Supported nuclear related work; excess salvageable materials from nuclear related programs kept here; U and mixed fission products occasionally found; Rad survey found area below acceptable limits.	None
4583-New Salvage Yard	No		B	EU-02	Supported Research & Development and nuclear related work; clean, salvageable, non-radioactive material removed from Old Conservation Yard and Old ESG Storage Yard moved here; no RAD materials stored here; nearby drainage gulley carried surface runoff from Sodium Reactor Experiment to catch pond. RAD survey found area below acceptable limits.	None
4040	Yes		D	EU-02	Building 4040 Protective Services Control Center, Contaminated Medical Facility, Facilities and Industrial Engineering, Office Supply Storage, Energy Technology Engineering Center (ETEC) Equipment Storage, Includes Building 4624, Fire Truck Canopy. Constructed in 1960 as an office building, Building 4040 housed a health physics counting lab for an unspecified period of time. Demolished in 1997. Building 4040, housed sealed check sources and a laboratory low-background alpha/beta counting system, used for counting air samples and wipe samples. Such activities would have been permitted under a blanket use authorization for health physics to use radiation-counting equipment.2 Sealed sources were checked annually to ensure that no leaks had occurred. There are no additional Use Authorizations and no Incident Reports associated with Building 4040. Direct frisk surveys were performed in February 1996 and survey results were below the acceptable limits. A smear survey was performed in February 16, 1996 and the survey results were below the acceptable limits (Acceptable Limits: 20 dpm/100 cm2 alpha, 100 dpm/100cm2 beta). Ambient gamma was measured in 4040 on February 20, 1996. Levels between 10 µR/hr and 12 µR/hr were detected. Direct frisk survey were performed in May 1, 1997, and survey results were below the acceptable limits (NDA). (HSA)	None
4540	No		D	EU-02	Site 4540, Parking Lot. Parking Lot 4540 was located directly south of Building 4040 and was used by personnel working in the building. Following the demolition of Building 4040 in 1997, Parking Lot 4540 was no longer used. There are no Use Authorizations and no Incident Reports associated with Parking Lot 4540. Radiological surveys specific to Building 4540 have not been conducted. (HSA)	None
4624	No	4040	D	EU-02	See 4040	See 4040
4783	No	4014	E	EU-03	See 4014	
4063	No		F	EU-03	Initially used as an electronics shop, later as a maintenance service building for non-radiological equipment. Also was used as a storage building and housed non-radiological equipment. No User Authorizations and no Incident Reports associated with Building 4063. Survey results for mixed fission were below the acceptable limits. (HSA)	None
4273	Yes		F	EU-03	Building 4273 was a protective clothing storage and the Radioactive Laundry area. Contaminated laundry from the Sodium Reactor Experiment (SRE), the Engineering Test Building (ETB) and the Radioactive Materials Disposal Facility (RMDF) was brought to Building 4273 and shipped off-site for cleaning. Minor contamination incidents and spills may have occurred in Building 4273. Because contaminated protective clothing was stored in this facility, contamination may have been spread during operation. A 1988 radiological survey showed survey results below the acceptable limits. (HSA)	None
4283	Yes		F	EU-03	See 4273	See 4273
4316	No	4273	F	EU-03	See 4273	See 4273
4003	Yes		G	EU-03	SRE Support Complex; Building used to assemble fuel for Sodium Reactor Experiment (SRE); used for the analysis of SNAP fuel burn-up samples and the evaluation of irradiation experiments. Following initial decontamination activities, the building was used as a non-radioactive storage building; sewer lines suspected of contamination were removed in September 1982. Radioactive material was managed at this facility in the form of uranium, thorium, transuranics, mixed fission products, and Co-60 and other activation products. Incidents that could have involved releases of radioactivity to the environment: On December 22, 1959, a contractor removed a radioactive exhaust stack without notifying Health Physics. On September 2, 1969, laboratory equipment and portions of the floor were found to be contaminated (though the method of contamination is not clear). All affected areas were decontaminated and there was no evidence that contamination was tracked outside of Building 4003 . On November 9, 1989, an incoming shipment of radioactive laser parts arrived from Stanford University without labels or authorization. Upon examination, the shipment was found not to exceed a safe level of radioactivity. A 1988 radiological survey indicated the area contained no measurable residual radioactivity. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232
4041	Yes		G	EU-03	SRE Support Complex; Building used as a storage area for contaminated equipment and packaged radiological material; was also used for interim storage of Rad waste prior to shipment for disposal. A 1982 interim post remedial action survey found four locations exceeded acceptable limits; locations exceeding release limits were decontaminated before the end of the survey. The 1984 ANL independent verification survey indicated Building 4041 and its surrounding area were decontaminated to below the limits specified in the draft American National Standards Institute (ANSI) Standard N13.12 and the Nuclear Regulatory Commission (NRC) guidelines dated 1982. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232
4143	See 4013		G	EU-03	SRE Reactor a high-temperature, sodium-cooled, graphite-moderated reactor between 1957 and 1964. Sites 4413 and 4894 through 4898 are concrete pads associated with Building 4143. They were only given separate designations on the 1962 Industrial Planning Map; subsequent maps include them as a part of Building 4143. Deactivation activities resulting in a “stored-in-place” configuration were conducted between 1967 and 1968. Decommissioning of the SRE began in 1974 and continued through 1983. Demolished in 1999. Demolition included the removal of the reactor and surrounding soil and concrete, as well as underground structures.; Radioactive material was managed at this facility in the forms of fuel and fission products. Several incidents may have resulted in releases to the environment. On June 4, 1959, an explosion resulting from an unexpected hydrogen-oxygen reaction blew a fuel element undergoing sodium cleaning out of the wash cell. Surveys indicated that no measurable release of radiation outside the building occurred. On July 12, 1959, depletion in coolant flow due to blockage resulted in overheating and damage to 13 of 43 fuel elements in the reactor core. Sufficient damage was sustained on these assemblies to cause failure of cladding on all seven rods and some iron uranium eutectic was molten for a short period of time in the reactor.3,4 Between	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232, H-3

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
					5,000 and 10,000 curies of mixed fission product were released and contained in the primary sodium system. Recently, it was calculated that approximately 28 curies of Kr-85 were released to the environment. On March 12, 1960, a contaminated sodium fire broke out in the sodium service vault. Personnel were unable to put out the fire with the standard suppression equipment, so the vault was sealed and purged with argon. Once the fire was extinguished, surveys indicated that no significant contamination had been released (e.g., an air sample during the fire measured 1.64 x 10-10 µCi/cc). On May 25, 1960, workers improperly removed a corescope from a gas lock for the reactor core, resulting in the release of gas containing mixed fission products from the core to the high bay. One worker was contaminated at a level of 1.2 mrad/hr; however, it is believed that no contaminated gas escaped the building. On June 9, 1960, failure of a gas lock for the reactor core resulted in the release of gas containing mixed fission products from the core to the high bay. Two workers were contaminated at a level of 5 mrad/hr; however, it is believed that no contaminated gas escaped the building. On April 10, 1961, a contaminated sodium fire broke out in a 30-gallon drum in the sodium service vault. Surveys of the vault and of the ventilation system indicated that no release in excess of allowable limits occurred as a result of the fire. On May 12, 1961, a steam cleaning operation contaminated a concrete pad. Contamination was as high as 1,200 dpm/100 cm2. The contaminated area was decontaminated following completion of steam cleaning activities. On October 20, 1962, several employees were contaminated while cutting core heaters and packaging them as radioactive waste for disposal. After completing the work, the employees changed out of the protective clothing without being properly surveyed. The contaminated employees then contaminated most doorknobs in the lower level of the SRE building (measured at 300 dpm/100 cm2) and a large area of the floor (contamination levels of up to 600 dpm/100 cm2 were measured). One contaminated employee went outside for lunch, but it is not known if he spread Group GS SFL Area IV HSA (May 2005 Final) G-17 contamination outside the building. Upon discovery of the contamination a short time later, the employees and the building were decontaminated to acceptable levels (30 dpm/100 cm2 for the building). On June 21, 1964, a component cleaning operation resulted in a high level of contamination (up to 150,000 dpm/100 cm2) being spread throughout the west end of the high bay. On March 19, 1964, 3,550 gallons of water were dumped from two liquid waste storage tanks. After approximately 24 hours, it was determined that the water released was contaminated with approximately 58 mCi of irradiated corrosion products. The SRE Retention Pond captured this contaminated water, preventing its spread. On December 18, 1964, workers engaged in the transfer, cutting, and storage of controls rod and safety rod lower thimbles contaminated the high bay area. Smear surveys measured beta-gamma levels of up to 3,000 dpm/100 cm2. The area was decontaminated and no contamination was thought to have escaped the high bay. On January 14, 1965, employees, and potentially the SRE high bay, were contaminated while moving an irradiated beryllium temperature probe with the high bay crane. Two workers each received 3.1 rem exposures during the operation. On December 8, 1967, radioactive water was discovered in 8-inch pipes that penetrated the maintenance cell floor. On October 23, 1976, core gas escaped during removal of an instrument thimble contaminating the high bay area. Removable contamination levels were found to be as high as 10,000 dpm/100 cm2. The area was decontamination to acceptable levels. On August 1, 1977, while workers were moving the cold trap, the bottom fell off, contaminating the floor. Contamination levels were found to be as high as 50,000 dpm. On August 10, 1977, the storage pit containing reactor vessel segments leaked water. Although the exact release point was uncertain, elevated radiation levels were founds in soil at the east end of the storage pit. It was estimated that approximately 0.6 Ci were released to the soil. On September 23, 1977, work in the SRE high bay contaminated the floor of that area. Prior to detection of the contamination, workers walked through the area, transporting the contamination out of the high bay. On November 14, 1977, workers overfilled a liquid transfer tank, spilling radioactive liquid on the ground outside the SRE facility. Surveys and soil sampling indicate all radionuclide concentrations meet the site-wide release criteria. (HSA)	
4153	No		G	EU-03	SRE Sodium Service Building contained the sodium service system. Records do not indicated that radioactive materials were handled in Building 4153. Surveys conducted of the Building indicated the building was below the acceptable limits. (HSA)	None
4163	Yes		G	EU-03	SRE Support Complex; West end of building designated for repair of radiologically contaminated equipment; east end was used for construction of wooden shipping containers and non-nuclear support work. It contained a pipe shop and a machine shop. Various RAD incidents occurred which may have resulted in releases to the environment. On December 7, 1964, an employee cut into a contaminated glove box, which began to smoke. This smoke, containing high airborne radiation, was released from the glove box, contaminating several workers. On December 21, 1964, an employee used a skill saw to cut into a contaminated wooden crib used in the disposition of the SRE Main Intermediate Heat Exchanger. Contaminated sawdust from cutting became airborne; however, surveys following the incident indicate no release above acceptable levels occurred. On November 1, 1966, cleaning of a primary sodium valve resulted in an explosion and spread of Cs-137, Na-22, Sr-90 and Y-90 airborne contamination at a level of 2 x 10-9 µC/cc. Following this incident, Building 4163 was decontaminated to acceptable levels. Most surveys and samples had results below the acceptable limits. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232
4183	No		G	EU-03	Fire Pump Building for the SRE complex no records indicate that radioactive material was handled in Building 4183. Radiological surveys results indicated results below the acceptable limits. (HSA)	None
4184	No		G	EU-03	SRE Battery Room and Diesel Generator Canopy. Not likely radioactive material was handled in the Building. All survey results were below the allowable limits. (HSA)	None
4505	No		G	EU-03	Served as a storage area near SRE. There are no records of what was stored here; however, given the proximity to SRE, radiological materials may have been stored here. It is not believed that radioactive material was handled here. Radiological surveys indicate the results were below acceptable limits. (HSA)	None
4653	Yes		G	EU-03	SRE Support Complex; Building 4653 Interim Radioactive Waste Vault served as a liquid and gaseous RAD waste holdup and decay system. All liquid waste generated by the reactor program was directed to this facility prior to final disposal. Radioactive waste was present at this facility mainly in the form of mixed fission products and activation products. Decon work included removal of buried tanks and associated pipes, removal of contaminated soil and scabbing of contaminated concrete within one of the vaults. Radiological surveys found the area to be below acceptable limits. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232
4683	No	4143	G	EU-03	See 4143	See 4143
4684	No		G	EU-03	Steam Generator Pad. Facility contained non-radioactive systems associated with the production of electricity by Southern California Edison. Radiological material was not handled at Building 4684. Survey results were below allowable limits. (HSA)	
4686	Yes		G	EU-03	Temporary Hot Waste Storage. This facility was used to store irradiated core components. Radioactive waste was present at this facility, primarily in the form of activation products and some mixed fission products. Radiological surveys in 1978 and again in 1984 had survey results below the acceptable limits for both surveys. (HSA)	None
4687	Yes		G	EU-03	Site 4687 was used as the loading dock for Building 4041. Since radioactive components and waste were stored in Building 4041, most likely RAD components and waste were likely handled on the loading dock. A 1982 interim post remedial action survey found Site 4687 exceeded acceptable limits for residual contamination. Locations exceeding release limits were decontaminated before the end of the survey. A 1984 independent verification survey indicated Site 4687 and its surrounding area was decontaminated to below acceptable limits. (HSA)	None
4689	Yes		G	EU-03	SRE Support Complex. Interim Storage of Contaminated Items. Facility was used as a storage area for potentially contaminated items from the SRE complex. Radioactive waste in the form of activation products and mixed fission products was likely present at this facility. This facility was totally removed prior to the SRE decommissioning. Contaminated blacktop located under and around the building was removed and the area was repaved. Radiological surveys in 1978 and 1984 shown results below the allowable limits. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232
4693	No	4003	G	EU-03	See 4003	See 4003
4695	Yes		G	EU-03	SRE Cold Trap Vault stored and trapped impurities for the SRE sodium system, including radiological materials. During the course of reactor operations, several primary sodium leaks and fires occurred within the vault. Radioactive materials were handled in this building because of its direct association with SRE activities. Based on preliminary surveys and process history, it was determined that Site 4695 was contaminated. As a result the total below-grade structure was removed and the area was backfilled and paved. In 1983, a radiological survey determined the land where Building 4695 had been located was acceptably free of contamination. (HSA)	None
4703	Yes		G	EU-03	Building 4703 was a water tower that stored emergency cooling water for the Edison Company steam generator portion of the Sodium Reactor Program. Radiological materials were not handled at Building 4703. A 1978 radiological survey found the area was acceptably free of contamination. This was confirmed by a 1984 independent verification survey. Building 4703 was destroyed in a brushfire prior to 1978. The remaining portion was removed in 1998. (HSA)	None
4723	Yes		G	EU-03	Site 4723; Sodium Cleaning Pad; Steam Cleaning Pad; Site was used for radiological sodium cleaning operations for equipment and materials associated with SRE. An incident occurred on March 19, 1960 when employees were steam cleaning of radioactive sodium pipe, causing contamination of the area. The contaminated concrete was chipped away from the pad surface and put in barrels for disposal. Contaminated soil was excavated and packaged for disposal as well. Following decontamination, the pad was fenced to limit access to the cleaning pad. Survey results indicated Building 4723	None

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
					and its surrounding area were decontaminated to below allowable limits. (HSA)	
4724	Yes		G	EU-03	Hot Oil Sodium Cleaning Facility was used for cleaning large pipes and assemblies from the secondary loop of the SRE reactor. There was a buildup of contamination from mixed fission products over the lifetime of the facility. Readings of a few mR/hr could be detected in several locations along the floor. Most of this activity was located inside a small trench along the west wall. Prior to 1978, the metal diamond-plate floor was cut free in an attempt to remove this contamination. Contamination could be detected in the underlying concrete at that time. Following decontamination activities, surveys found the area was acceptably free of contamination and below the allowable limits. (HSA)	None
4733	Yes		G	EU-03	Sodium Cleaning Pad for the SRE complex. It is not likely radioactive materials were handled at Building 4733. Radiological surveys found the area was below allowable limits. (HSA)	None
4743	Yes		G	EU-03	Building 4743 housed a Tetralin Heat Exchanger for SRE no known radioactive materials were handled at this facility. Radiological surveys found the area to be below allowable limits. (HSA)	None
4753	Yes		G	EU-03	SRE Primary Fill Tank Vault. Radioactive materials were handled in this facility. Based on preliminary surveys and process history, it was determined Building 4753 was contaminated. The total below-grade structure was removed and the area was backfilled and paved. In 1983, a radiological survey of the region was conducted as part of the Building 4143 survey. The survey found that the area was acceptably free of contamination and recommended it be released for unrestricted use. An independent verification survey in 1984 indicated the are was below allowable limits. (HSA)	None
4773	Yes		G	EU-03	SRE Support Complex; SRE Drainage Control Dam and Retention Pond; Waste Water Impound Dam; Radiological Materials were not deliberately dumped in the pond; however, SRE site records indicate two spills that could have potentially affected the pond. In the 1960s, liquid waste storage tanks near Building 4653 overflowed. The spill appeared to be confined to the local area and was cleaned up quickly. On March 19, 1964, 3,550 gallons of test water were drained from liquid waste tanks at the SRE, sending radioactively contaminated solutions to the SRE Retention Pond and consequently to the Area II Delta Ponds. The total release did not exceed 60 mCi.1 The concentration in the SRE pond was less than 2 pCi/cc, and less than 0.1 pCi/cc in the Delta Ponds. In 1979, the pond was drained and allowed to dry out. All areas of the pond bottom that read more than about 100 cpm above background or that exceeded 100 pCi/g gross detectable beta activity, were removed and disposed of as radioactive waste. Afterwards, soil samples were taken and the pond was returned to service. Radiological surveys indicated area was below allowable limits. In 1995 soil samples were taken in and around the SRE pond. The maximum level of cesium-137 detected was 2.4 pCi/g. In November 2002, twelve soil samples were taken in the SRE pond and in the drainage leading to the pond. Cesium-137 levels ranged from non-detect to 2.6 pCi/g. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232
4894	Yes	4143	G	EU-03	See 4143	See 4143
4895	Yes	4143	G	EU-03	See 4143	See 4143
4896	Yes	4143	G	EU-03	See 4143	See 4143
4897	Yes	4143	G	EU-03	See 4143	See 4143
4898	Yes	4143	G	EU-03	See 4143	See 4143
4413	No	4013	L	EU-03	See 4013	See 4013
4014	No		E	EU-04	Sodium Storage Building used to store metallic sodium; no Use Authorizations and no Incident Reports associated with Building; Rad survey found area below acceptable limits.	None
4030	Yes		E	EU-04	Van de Graaff Accelerator - Built for research with a small accelerator neutron source; housed a Van de Graf accelerator until it was removed then used a site purchasing office and for traffic and warehousing. Regulated RAD materials were managed at this facility; COC is tritium; associated leachfield not located during D&D believed to be under Building 4641; No incident reports associated with Building 4030; during smear survey H-3 contamination detected; areas were decontaminated; 1988 survey showed results were below the acceptable limits; exterior soil samples showed average H-3 at 5.31 pCi/l in soil; 1996 Final Comprehensive Radiological Survey revealed survey results below the acceptable limits; DHS verification sampling in 1996 and 1998 supported release for unrestricted use.	H-3
4033	No	4053	E	EU-04	See 4053	
4035	Yes	4030	E	EU-04	See 4030	
4043	No	4053	E	EU-04	See 4053	
4046	No		E	EU-04	Radiological materials not handled in this facility; no Use Authorizations and no Incident Reports associated with Building 4046. (HSA)	None
4053	No		E	EU-04	Served as Fire Department Service Building; No Use Authorization and no Incident Reports associated with Building 4053; no RAD surveys have been conducted. (HSA)	None
4064	Yes		E	EU-04	Fuel Storage Facility - vault to provide secure storage for non-irradiated, fissionable nuclear material (enriched U & Pu) used to make reactor fuel; enriched U powders and source material powder packages split into smaller units or combined into larger units in a glove box; Yard areas used to store 55-gal drums of LL enriched recoverable scrap; 1980s after all fissionable materials removed, used to store miscellaneous equipment and containers of RAD waste (principally soil). COCs include U isotopes, Pu, Th, activation products; initially sanitary wastewater discharged to local sewage system; Incident Reports - 1963 an area of soil and concrete was discovered to have elevated levels of radioactivity (Cs-134, 137); soil and concrete found to be contaminated with mixed fission products. Source of contamination not discovered but believed was result of a leak from a drum containing Seawolf submarine reactor fuel pins. The area was excavated reducing the contamination to an acceptable level. 1964 discovered a can of uranium carbide had oxidized inside the shipping container (“birdcage”), causing the lid of the can to blow open and the bottom of the can to warp resulting in alpha radiation levels on the concrete dock to increase from less than 1 dpm/100 cm2 (clean level) up to 200 dpm/100 cm2. 1970 a significant increase in alpha radioactivity detected on vegetation in the Side Yard revealed that a 55-gallon drum containing U_{308} had been opened outside on a piece of plastic sheeting. U_{3O8} was visible on the sheeting and its was believed that some had been dispersed by wind in the area, contaminating the vegetation. The plastic sheeting was removed and appropriately dispositioned. Various surveys and sampling over the years has revealed contaminated areas in the side yard with elevated levels of Cs-137. Each time remediation was performed on the contaminated area. The final verification survey conducted in 1998 showed exposure rates were below the acceptable limit. Also the soil samples revealed the Cs-137 levels were below the DCGL. (HSA)	Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154
4333	No	4513	E	EU-04	See 4513	
4513	No		E	EU-04	Asphalt Parking lot between Buildings 4064 and 4030. All the facilities surrounding the parking lot handled radioactive material or radiologically contaminated equipment. No known contamination incidents occurred. A radiological survey in 1988 by Rocketdyne showed survey results were below the acceptable limits. (HSA)	None
4535	Yes		E	EU-04	Asphalt parking lot between Buildings 4641 and 4030. All the facilities surrounding the parking lot handled radioactive material or radioactively contaminated equipment. No known contamination incidents occurred, but radioactive contaminants were suspect in this area because of operational history. A 1988 radiological survey by Rocketdyne showed survey results were below the acceptable limits. (HSA)	None
4641	Yes		E	EU-04	See 4030; Building 4641 served as a transfer point for all SSFL incoming and outgoing shipments including radioactive materials. RAD shipments were handled on the outdoor dock only and were never stored in the warehouse. A radiation detector alarm installed in the dock never triggered. Radioactive materials were no longer handled after 1985. Survey results were below acceptable limits. (HSA)	None
4864	Yes	4064	E	EU-04	See 4064	
4XXX	No	4030 and 4641	E	EU-04		
4763	No	4063	F	EU-04	See 4063	See 4063

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4133	No		G	EU-04	Hazardous Waste Treatment/Management Facility; Building 4133 was physically transferred to its present location in 1977. It was previously labeled as Building 4724, Contaminated Sodium Facility. Prior to its move, it was surveyed for radiological contamination and released for unrestricted use. The are no Use Authorizations and no Incident Reports associated with Building 4133. Soil samples collected in 1988 were below soil release limits. In 2000, survey of the interior and exterior of the building including surrounding soil was conducted. All release criteria were met. (HSA)	Am-241, Cs-137, Ra-226, Th, U
4654	Yes		G	EU-04	SRE Support Complex - Building 4654 Interim Storage Facility constructed to store dummy and spent fuel elements, shipping/storage casks and radiological waste generated at the SRE, the Organic Moderated Reactor (OMR) and SNAP programs. During excavation, a hydraulic hammer mounted on a backhoe punctured one of the storage tubes. The storage tube and surrounding area were surveyed and found to be free of contamination. Several incidents are recorded for this facility that could have involved releases of radioactivity to the environment. On January 23, 1962, contamination from equipment stored outside spread from inside the fenced area to asphalt outside the fence. Samples indicated contamination levels ranged from 2 mrad/hr to 17 mrad/hr. No decontamination was conducted. On July 5, 1979, contaminated shipping casks stored in the area were found to be emitting high levels of radiation (up to 35 mR/hr). During D&D soil samples were taken and while most were found to contaminated with Cs-137 all contamination was found to be below 2.0 pCi/g. In 1988 additional soil samples were analyzed for gross alpha and gross beta. Results were below soil release limits, however some appeared higher that background. In 2003 22 soil samples were collected in Grid Blocks S-19 and T-19, neighboring Building 4654. It was suspected this area was used for storage of materials from SRE operations. Cs-137 ranged from non-detect to 4 p/Ci/g; also analyzed for Am-241 (all non-dect), Co-60 (21 non-detect, 1 0.5 p/Ci/g), Pu-238 (all non-detect), Pu-239 (21 non-detect, one sample 0.04 pCi/g), and Sr-90 (two samples were 1.2 and 0.9 pCi/g, the rest were non-detect). Uranium and thorium were at background levels. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232
4073	Yes		H	EU-04	KEWB Reactor. Constructed in the early 1950s, the KEWB reactor was a small graphite-encased research reactor that used a water solution of uranyl sulfate as fuel. The “A” Core (spherical) went critical on July 13, 1956, and was removed in August of 1959. The “B” Core (cylindrical) went critical March 1960. Operations halted in 1966. In 1968 the fuel was drained and decontamination began. Demolished in 1975. Activities included the following: Demolition of all non-concrete portions of 4073; Removal of the tank system; Backfilling the remaining floor and walls with asphalt rubble and covering it with six feet of earth; Grading and re-vegetating of the site. The site was released for unrestricted use on March 3, 1976, by the Energy Research and Development Administration (ERDA). The reactor had a capacity of 50 kWt, but did not normally operate at full power; the majority of reactor operations were conducted at a power level of 1 kWt or less. Reactor fuel for the KEWB reactor was U-235 dissolved as uranyl sulfate in solution. The radionuclides of concern are Co-60, Cs-137, Eu-152, Eu-154, Sr-90, U-238 and U-235. Two incidents associated occurred in Building 4073 that resulted in employee exposure, and could have resulted in a potential release to the environment. On February 10, 1958, KEWB reactor operators received weekly exposures greater than 300 mrem while performing core maintenance activities. Upon further investigation, it was concluded that the elevated levels were a result of dosimeter error, and that actual exposures were within permissible levels. From April 1 to June 30, 1961, a research engineer conducting KEWB reactor core experiments received a quarterly exposure to gamma and neutron radiation at levels greater than 3 rem. These core experiments were required for successful termination of the KEWB Program and resulted in high radiation levels in the reactor room, and consequently caused the employee’s exposure. The employee was aware of his high cumulative exposure in early May; however, due to the importance of the tests and lack of other qualified operators, he continued to conduct “unreflected” core experiments without prior approval to exceed the 3 rem quarterly limit. In July 1975, Rocketdyne performed a surface scan of the KEWB site to confirm that no radiological contamination remained. The survey found no levels of beta-gamma surface contamination above the measured background (0.15 – 0.25 mrad/hr). Survey results were below acceptable limits. In 1976, Rocketdyne performed a final radiological survey during decontamination and demolition (D&D) of the facility and published results in the final D&D report. Survey results found that all remaining surfaces were decontaminated to levels as low as reasonably achievable; in all cases below the levels for future unrestricted use (removable contamination of 20 dpm/100cm2α or 100 dpm/100cm2β). Survey results were below the acceptable limits. In May 1983, Argonne National Laboratories performed a post-remediation radiological survey. The survey performed a surface scan to determine ambient gamma exposure rate and low-level radiation level. Also, soil samples were taken and analyzed for gamma radiation and uranium. The survey found no measurements above background. Background is relatively high (40 µR/hr and 8,000 cts/min) due to shine from nearby Building 4021 and Building 4022. The survey concluded that the site could be released for unrestricted use. In August 1988, Rocketdyne performed a surface scan measuring ambient gamma exposure rate to ensure no contamination existed as a result of radioactive materials movement. Mean exposure rate: 17.4 ± 0.96 µR/hr (–0.2 ± 0.96 µR/hr when corrected for background). Background: 17.0 µR/hr. Acceptable limit: 5.0 µR/hr above background. Survey results were below the acceptable limits. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241
4074	No		H	EU-04	Building 4074 Storage Building, KEWB Film Processing Building. Constructed in 1958, Building 4074 was constructed to serve as a storage and film processing building where personnel processed photographic oscillograph paper for KEWB. Ownership transferred from AEC to Rockwell in 1972. The Nuclear Regulatory Commission (NRC) licensed the facility on January 5, 1972 (R-118 Docket No. 50-375). Demolished in 1980. The foundation and any remaining concrete were left in place. Released for unrestricted use and NRC license terminated March 19, 1987. There are no Use Authorizations and no Incident Reports associated with Building 4074. In 1985, Rocketdyne conducted a final radiological survey, releasing the final report in March 1986. (The survey included Buildings 4073, 4074, 4083, 4084, 4093, 4453 and 4453). Soil samples showed no evidence of radioactivity due to facility operations. Maximum average alpha: 17.2 dpm/100cm2 (limit is 5,000 dpm/100cm2). Maximum average beta: 1,987 dpm/100cm2 (limit is 5,000 dpm/100cm2). The maximum ambient exposure rate was originally found to be 23.1 µR/hr (limit is 18.9 µR/hr). The ambient exposure rates over the limit were attributed to the nearby Radioactive Materials Disposal Facility (RMDF) and do not represent residual contamination. The survey found that measured radiation levels were below acceptable limits, making the site acceptable for unrestricted use. NRC conducted a decommissioning inspection in 1987. Results of the inspection determined the maximum exposure rate to be below the limit of 5 µR/hr above background, meeting the criteria for unrestricted use. (HSA)	None
4083	Yes		H	EU-04	Building 4083 Reactor Kinetics Control Building, Office and Laboratory Building, Includes Building 4103, Reactor Kinetics Lab and Storage. Constructed in 1958, Building 4083 was constructed to serve as the control building for the KEWB reactor. Ownership transferred from the Atomic Energy Commission (AEC) to Rockwell in 1972. NRC Licensed the facility January 5, 1972 (R-118 Docket No. 50-375). In the early 1970s, Building 4083 was modified to include the Reactor Kinetics Lab and Storage (Building 4103), changing the footprint of Building 4083. Demolished in 1980. The foundation and any remaining concrete were left in place. Building 4083 was released for unrestricted use by NRC and the NRC license was terminated March 19, 1987. There are no Use Authorizations and no Incident Reports that may have resulted in a release to the environment associated with Building 4083 or Building 4103. In 1985, Rocketdyne conducted a final radiological survey, releasing the final report in March 1986. (The survey included buildings 4073, 4074, 4083, 4084, 4093, 4453 and 4453). Soil samples showed no evidence of radioactivity due to facility operations. Maximum average alpha: 17.2 dpm/100cm2 (limit is 5,000 dpm/100cm2). Maximum average beta: 1,987 dpm/100cm2 (limit is 5,000 dpm/100cm2). The maximum ambient exposure rate was originally found to be 23.1 µR/hr (limit is 18.9 µR/hr). The ambient exposure rates over limit were attributed to the nearby RMDF and do not represent residual contamination. The survey found that measured radiation levels are below acceptable limits, making the site acceptable for unrestricted use. NRC conducted a decommissioning inspection in 1987. Results of the inspection determined the maximum exposure rate to be below the limit of 5 µR/hr above background meeting the criteria for unrestricted use. (HSA)	None
4093	Yes		H	EU-04	L-85 Reactor. Building 4093, Neutron Radiography Building, AE-6 Reactor, Includes Site 4893, Pad (AE-6). Constructed in 1958, Building 4093 was constructed to house the AE-6 Reactor. The AE-6 Reactor was originally called the Water Boiler Neutron Source (WBNS) reactor. Built in 1952 in Downey, CA, the WBNS had a maximum power of 0.5 Wt.The WBNS was modified to produce a maximum power of 3 kWt and moved to Santa Susana Field Laboratory (SSFL), where it was referred to as the AE-6 Reactor. Ownership was transferred from AEC to Rockwell in 1972, and the reactor was renamed L-85. The NRC licensed the facility in 1972 (R-118 Docket No. 50-375) and it operated until February 29, 1980. Demolition began in 1982 with removal of uranyl sulfate. The rest of the building, excluding the foundation, was demolished in 1995. The sanitary leachfield for Building 4093 was removed in 1999. The site was released for unrestricted use by NRC and the NRC license was terminated March 19, 1987. Reactor fuel for the L-85/AE-6 reactor consisted of U-235 (93.11% enrichment), dissolved as uranyl sulfate in 12.5l of 0.35 molar H2SO4 solution. The radionuclides of concern are Co-60, Cs-137, Eu-152, Eu-154, Sr-90, U-238 and U-235. There have been three incidents associated with Building 4093 that may have resulted in a release to the environment. On March 25, 1959, fission gas was released into the air, contaminating part of the high bay and employees. Contamination levels were measured from 7.5 mR/hr to 13 mR/hr. On July 30, 1982, rinse water contaminated with 5 ml of U-235 was spilled during the fuel draining operation, contaminating an employee and an area of the high bay floor. The area was partially decontaminated at the time and fully decontaminated during facility decommissioning. On May 24, 1995, a radioactive high efficiency particulate air (HEPA) filter was found in a pile of debris. The filter was taken to RMHF, where it was packaged for disposal as low-level radioactive waste. In 1985, Rocketdyne conducted a final radiological survey, releasing the final report in March 1986. (The survey included buildings 4073, 4074, 4083, 4084, 4093, 4453, and 4453). Soil samples showed no evidence of radioactivity due to facility operations. Maximum average alpha: 63.0 dpm/100cm2 (limit is 5,000 dpm/100cm2). Maximum average beta: 3102 dpm/100cm2 (limit is 5,000 dpm/100cm2). The maximum ambient exposure rate was originally found to be 21.3 µR/hr (limit is 18.9 µR/hr). The concrete was removed from areas measuring over the limit and the re-survey showed them all to be under the limit, with the highest measurement at 18.2 µR/hr. Survey results were below the acceptable limits. Oak Ridge Associated Universities conducted a confirmatory survey in 1986; the final report was released in December 1986. (The survey included Buildings 4073, 4084, 4093 and 4453.) The survey concluded that the L-85 reactor building (4093) had been remediated to the existing NRC criteria with the exception of exposure rate criteria. Restoration of the remediated area would reduce the exposure rate to the levels	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
					established by the Dismantling Order. NRC conducted a decommissioning inspection in 1987. The results of the inspection determined the maximum exposure rate to be below the limit of 5 µR/hr above background, meeting the criteria for unrestricted use. In 1999, confirmatory samples collected after the removal of the septic tank found no detectable activity (limit was 20 dpm/100cm2 for alpha and 100 dpm/100 cm2 for beta). (HSA)	
4103	Yes	4083	H	EU-04	See 4083	See 4083
4123	Yes		H	EU-04	Building 4123 KEWB Waste Storage Building. Constructed in the early 1950s, Building 4123 was used for the temporary storage of radiological waste material and was demolished in 1975. On March 3, 1976, the ERDA released the land on which Building 4123 had been located for unrestricted use. There are no Use Authorizations and no Incident Reports associated with Building 4123. In 1975, Rocketdyne performed a final radiological survey during D&D of the facility, publishing the results in the final D&D report in 1976. The survey found that all remaining surfaces were decontaminated to levels as low as reasonably achievable, and in all cases below the levels for future unrestricted use (removable contamination of 20 dpm/100cm2α or 100dpm/100cm2β). The survey concluded that the site was free of radioactivity except for normal background. In July 1975, Rocketdyne performed a surface scan of the KEWB site to validate that no radiological contamination remained. The survey found no levels of beta-gamma surface contamination above the measured background (0.15 – 0.25 mrad/hr). In May 1983, Argonne National Laboratories performed a post remediation radiological survey to verify that the site was free of radioactivity except for normal background. The survey performed a surface scan to determine the ambient gamma exposure rate and low-level radiation level. Also soil samples were collected and analyzed for gamma radiation and uranium. The survey found no measurements above background. Background is relatively high (40 µR/hr and 8,000 cts/min) due to the shine from nearby Buildings 4021 and 4022. The survey concluded that the site could be released for unrestricted use. In August 1988, Rocketdyne performed a surface scan of the terrains measuring the ambient gamma exposure rate to ensure no contamination exists as a result of radioactive materials movement. Mean ambient gamma: 17.4 ± 0.96 µR/hr. Background: 17.0 µR/hr. Acceptable limit: 5.0 µR/hr above background. Survey results were below the acceptable limits. (HSA)	None
4453	Yes		H	EU-04	Building 4453 AE-6 Fuel Handling Building was constructed in 1958. Fuel for the L-85 reactor in the form of uranyl sulfate was handled in Building 4453. Ownership of Building 4453 was transferred from AEC to Rockwell in 1972. The NRC licensed the facility on January 5, 1972 (R-118 Docket No. 50-375). Demolished in 1980. The foundation and concrete remain. Building 4453 was released for unrestricted use by NRC and the NRC license terminated March 19, 1987. Fuel for the L-85 reactor in the form of uranyl sulfate was handled in Building 4453. Accordingly, the contaminant of concern is uranium. There are no Use Authorizations associated with Building 4453. No incidents in which contamination may have been released the environment occurred in Building 4453. In 1985, Rocketdyne conducted a final radiological survey, releasing the final report in March 1986. (The survey included Buildings 4073, 4074, 4083, 4084, 4093, 4453 and 4453). Soil samples showed no evidence of radioactivity due to facility operations. Maximum average alpha: 17.2 dpm/100cm2 (limit is 5,000 dpm/100cm2). Maximum average beta: 1987 dpm/100cm2 (limit is 5,000 dpm/100cm2). The maximum ambient exposure rate was originally found to be 23.1 µR/hr (limit is 18.9 µR/hr). The ambient exposure rates over the limit were attributed to the nearby RMDF and do not represent residual contamination. Survey results were below the acceptable limits. NRC conducted a decommissioning inspection in 1987. Results of the inspection determined the maximum exposure rate to be below the limit of 5 µR/hr above background meeting the criteria for unrestricted use. (HSA)	None
4523	No		H	EU-04	Constructed in the 1950s, Site 4523 was a parking lot used by personnel working in L-85, KEWB and the adjacent facilities. Site 4523 was demolished. There are no Use Authorizations and no Incident Reports associated with Site 4523. Radiological surveys specific to Site 4523 have not been conducted.(HSA)	None
4633	No		H	EU-04	Site 4633 Reactor Cooling Water Pad was constructed prior to 1962. There is no record of activities associated with Site 4633. Demolished in the late 1980s. Regulated radiological materials were not handled in Site 4633. There are no Use Authorizations and no Incident Reports associated with Site 4633. Radiological surveys specific to Site 4633 have not been conducted. (HSA)	None
4643	Yes		H	EU-04	Building 4643 KEWB Exhaust Building was constructed in early the 1950s. Building 4643 was an exhaust building that provided ventilation for the KEWB reactor building and was demolished in 1975. The land on which Building 4643 was located was released for unrestricted use on March 3, 1976, by the ERDA. There are no Use Authorizations and no Incident Reports associated with Site 4643. In July 1975, Rocketdyne performed surface scans of the KEWB site to validate that no radiological contamination remained. The survey found no levels of beta-gamma surface contamination above the measured background (0.15 – 0.25 mrad/hr). The survey concluded that there was no radiation above background levels observed away from the site. In 1976, Rocketdyne performed a final radiological survey during D&D of the facility; the results were published in the final D&D report. The survey found that all remaining surfaces were decontaminated to levels as low as reasonably achievable; in all cases below the levels for future unrestricted use (removable contamination of 20 dpm/100cm2α or 100 dpm/100cm2β). The survey concluded that the site was free of radioactivity except for normal background. In May 1983, Argonne National Laboratories performed a post remediation radiological survey to verify that the site was free of radioactivity except for normal background. The survey performed a surface scan to determine the ambient gamma exposure rate and low-level radiation level. Soil samples were collected and analyzed for gamma radiation and uranium. The survey found no measurements above background. Background is relatively high (40 µR/h and 8,000 cts/min) due to the shine from nearby Buildings 4021 and 4022. The survey concluded that the site could be released for unrestricted use. On August 1988, Rocketdyne performed a surface scan of the terrain measuring ambient gamma exposure rates to ensure that no contamination existed as a result of radioactive materials movement. Mean ambient gamma: 17.4 ± 0.96 µR/hr. Background: 17.0 µR/hr. Acceptable limit: 5.0 µR/hr above background. The survey results found no contamination above background levels. (HSA)	None
4893	Yes	4093	H	EU-04	See 4093	See 4093
4563	Yes		I	EU-04	Site 4563, Building 4633 Storage Yard; Covered Storage Area Neighboring Building 4075. Constructed in 1958, Site 4563 was a paved storage area at RMHF. The area is still in use as a storage area today, but no longer is designated as Building 4563. Instead, it is referred to as the "covered storage area neighboring Building 4075." Radioactive waste was stored here pending shipment to a disposal facility. The most probable contaminants of concern are uranium, plutonium, thorium isotopes and mixed fission products. There are no Incident Reports associated with Building 4563. There have been several surveys of the entire RMHF complex, including Building 4563, during its operation. The results of these surveys are summarized in the 4021 site summary. Routine quarterly radiological surveys are conducted in the area to verify that Building 4563 has not become contaminated above the limits established by 10 CFR 835.5. (HSA)	U, Th, Pu, mixed fission products
4029	Yes		E	EU-05	Radioactive Measurement Facility - Stored radioactive source materials (Ra-336, Co-60, PoBe, PuBe, and Cs-137) for instrument calibration; later used as non-radioactive hazardous materials storage building for alkali metals (Na, NaK, Li, LiH2) and alkali metal contaminated components; all below-grade enclosures were removed and disposed of as LLW, excavations were backfilled to allow for continued use of the facility; barrels with unknown contents stored outside building for a short time surveys found no detectable activity; two incidents have occurred; 1964 a leaking calibration source contaminated building and personnel with 24.8 mCi Ra-226; contamination primarily confined to source storage well and the source thimble; area outside the source holder was decontaminated and surveyed, damaged source was removed and sealed; 1970 encapsulation of a 4.6 Ci Cs-137 calibration source failed during use, becoming stuck in the storage well. External radiation level of the source estimated at 16R/hr one foot from the source. Soil samples collected in 1996 during final D&D effort, identified Pb-214(0.28 & 0.27 pCi/g) and K-40 (23.1 & 23.6 pCi/g); EPA conducted oversight verification survey in 2001; scans for fixed and removable for alpha and beta were included also 6 swipe samples and dust samples were collected from 2 ventilation ducts; COC was Ra-226 on floors and walls; no measurements indicated the presence of radionuclides above acceptable limits.	Ra-226, Cs-137, Pb-214, K-40
4185	Yes		G	EU-06	Steam Generator Control Building for the SRE area. It is not likely that radioactive material was handled here. Radiological survey results were below the allowable limits. (HSA)	None
4793	No		H, N	EU-06	Building 4793 KEWB Electrical Building was constructed in the early 1950s. Building 4793 housed the heating and air conditioning systems for the KEWB reactor building and was demolished in 1975. The land on which Building 4793 was located was released for unrestricted use March 3, 1976, by the ERDA. There are no Use Authorizations and no Incident Reports associated with Building 4793. In 1975, Rocketdyne performed a final radiological survey during D&D of the facility; the results were published in the final D&D report in 1976. The survey found that all remaining surfaces were decontaminated to levels as low as reasonably achievable; in all cases below the levels for future unrestricted use (removable contamination of 20 dpm/100cm2α or 100 dpm/100cm2β). The survey concluded that the site was free of radioactivity except for normal background. In July 1975, Rocketdyne performed surface scans of the KEWB to confirm that no radiological contamination remained. The survey found no levels of beta-gamma surface contamination above the measured background (0.15 – 0.25 mrad/hr). The survey concluded that there was no radiation above background levels. In May 1983, Argonne National Laboratories performed a post remediation radiological survey to verify that the site was free of radioactivity except for normal background. The survey performed a surface scan to determine the ambient gamma exposure rate and low-level radiation levels. Soil samples were collected and analyzed for gamma radiation and uranium. The survey found no measurements above background. Background is relatively high (40 µR/hr and 8,000 cts/min) due to the shine from nearby Buildings 4021 and 4022. The survey concluded that the site could be released for unrestricted use. In August 1988, Rocketdyne performed surface scans measuring ambient gamma exposure rates to ensure that no contamination existed as a result of radioactive materials movement. Mean ambient gamma: 17.4 ± 0.96 µR/hr. Background: 17.0 µR/hr. Acceptable limit: 5.0 µR/hr above background. The survey found no contamination above background levels. (HSA)	None

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4021	Yes		I	EU-06	RNHF. Building 4021, Radioactive Material Handling Facility (RMHF) Waste Decontamination and Packaging, Radioactive Material Disposal Facility (RMDF) Waste Decontamination and Packaging. Constructed in 1959, Building 4021 has been used during decommissioning programs to process waste materials from the Sodium Reactor Experiment (SRE), Southwest Experimental Fast Oxide Reactor (SEFOR), Experimental Breeder Reactor (EBR), Fermi Reactor, Systems for Nuclear Auxiliary Power (SNAP) and other on-site programs. Building 4021 is still active and continues to be used as a processing area for wastes from various on-site decontamination and decommissioning (D&D) programs. Radioactive materials were handled in Building 4021 primarily in the form of mixed fission products and fuels. Multiple incidents have occurred at this facility. The following are incidents which may have involved releases to the environment. On June 10, 1964, an explosion and fire broke out in a storage can as a result of a sodium reaction. Contaminated smoke caused increased levels of airborne contamination, though the smoke did not escape the building. On July 21, 1964, an explosion and fire broke out in a storage can as a result of a sodium reaction. Contaminated smoke caused increased levels of airborne contamination, though the smoke did not escape the building. On December 22, 1964, a component from the Sodium Reactor Experiment was taken to Building 4021 for decontamination. The component had water in it, which leaked when a plastic covering broke. As a result, a concrete pad, asphalt, and a forklift required decontamination. On May 13, 1965, the flocculation tower overflowed, spilling radioactive water onto equipment, the pad and the surrounding soil. On November 11, 1966, a water evaporator pan caught fire, causing the filters to plug and collapse. Sampling indicated that no significant release of radioactive materials occurred. On November 3, 1976, the leach field connected to the building was found to be contaminated at levels up to 200 mrad/hr. On February 15, 1978, the contaminated leach field flooded with rainwater, resulting in the release of water contaminated with Sr-90 at a level of 4 x 105 µCi/ml gross beta activity (A0064). On October 3, 1997, four concrete blocks in the parking lot were found to have beta contamination ranging from 100 to 800 counts per minute. The concrete blocks were decontaminated, resurveyed and released without radiological restrictions. The following activities occurred relating to the leach field associated with Building. The RMHF leach field was constructed in the spring of 1959 as a sanitary sewer leach field. In 1961, the leach field became unnecessary when the Area III sewage disposal system began accepting sanitary waste. In the fall of 1962 or spring of 1963, a valve to the RMHF radioactive water processing system was inadvertently left partially open and allowed an unknown amount of contaminated water to enter the leach field system. In 1976, contamination of the leach field was discovered and decontamination and removal plans were prepared. Levels of contamination were as high as 115,000 pCi/g. Decontamination and removal activities occurred from 1976 to 1978. Approximately 36,250 cubic feet of contaminated soil and sludge were shipped to radioactive waste disposal sites. An estimated 0.6 mCi of radioactive material remains sequestered in inaccessible recesses and three contaminated cracks in the bedrock. During January and February of 1978, heavy rains caused contaminated water to leach out of the soil (see incident A0064 referenced above). A special environmental survey of the RMHF area was performed in January 1966. Gross beta/gamma radioactivity concentrations for samples of soil, vegetation and water were obtained along the north fence (outside), the drum storage yard and in the ravine below the facility. The survey consisted of 17 soil samples, 12 vegetation samples, and 8 water samples. Gross beta gamma radioactivity ranged from: • 26 to 1005 pCi/gram beta-gamma in soil; • 161 to 70,680 pCi/gram beta-gamma in vegetation; • 30 to 30,400 pCi/liter beta-gamma in water; • In 1978, the leach field was surveyed at the end of decontamination activities. The survey consisted of 79 random soil samples taken from the surface of the leach field cover. Gross beta activities of the soil ranged from 15 to 46 pCi/g. A complete walk-through survey was also conducted. The maximum gamma exposure rate following backfill was 30 to 50 µR/hr, apparently from stored waste at the RMHF just a few hundred yards away. No contribution from the leach field itself could be detected. The site was left with a minor amount of radioactive material in three cracks in the sandstone rock (estimated 0.6 mCi). The cracks are over 10 feet below the surface and were sealed with bituminous asphalt mastic. Survey results indicated that the site was suitable for unrestricted use. In 1981 a survey was conducted to support the RMHF decommissioning. The survey indicated there were low levels of fixed and removable contamination on and in some portions of the RMHF asphalt and in the soil beneath the asphalt paving. There were also spot areas of contamination in the soil outside the north, west and south fence perimeters. There were 37 soil samples collected at the surface and 12 inches below the surface at each sample location and analyzed for gross beta/gamma activity. The activities of the soils at the surface ranged from 21 to 1143 pCi/g. The activity of the soil at 12" depth ranged from 20 to 104 pCi/g. In 1989, soil samples were collected around the RMHF Leach Field. In addition, boulders located on the north slope of the leach field backfill, leading down to, and including the ravine were surveyed for beta radiation. One boulder at the bottom of the ravine was emitting beta radiation above background levels. The highest level was 400,000 dpm/100cm2. 15 soils samples were collected from 6 areas surrounding the leach field. Gross alpha ranged from 28.9 to 313.1 pCi/g Gross beta ranged from 26.0 to 2121.0 pCi/g. In 2000, a survey of the RMHF and surrounding area was conducted. 23 soil samples were collected south, west, and north of the RMHF fenceline and analyzed for Cs-137: 13 samples were <MDA to 1 pCi/g; 6 samples were 1 to 10 pCi/g; 4 samples were 10 to 53 pCi/g; 6 samples were taken from the leach field area 5 samples were typical of background (<0.2 pCi/g); 1 sample was 1.2 pCi/g. In 2003, 49 soil samples were collected from a localized area outside the south fence of RMHF to characterize the area. Cs-137 was detected in most of the samples. The average Cs-137 concentration was 27 pCi/g, ranging from non-detectable to 124 pCi/g. Following excavation (~12 ft x ~50 ft x ~2 ft), six confirmation samples were collected and the average Cs-137 concentration was lowered to 3.75 pCi/g, ranging from 1.65 to 7.08 pCi/g. The entire RMHF facility, including Building 4021, will be surveyed and decontaminated for unrestricted use at the time of RMHF closure. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, H-3
4022	Yes		I	EU-06	RNHF. Building 4022, RMDF Radioactive Vault Storage, RMHF Radioactive Vault Storage. Constructed in 1959, the vaults in Building 4022 have been used for the storage of SRE fuel, SEFOR fuel, EBR-II blanket assemblies, SRE decommissioned waste, plutonium, Fermi Reactor fuel, high-level radioactive waste and other waste from on-site decommissioning activities. Building 4022 is active, and continues to be used as a storage area for wastes from decommissioning activities throughout the site. The building also contains a compactor, which is used to size reduce low-level radioactive waste. Radioactive materials were handled in Building 4022 primarily in the form of mixed fission products and fuels. Multiple incidents were associated with this facility. The incidents involving a possible release to the environment were: On December 29, 1965, drums of contaminated sodium exploded in a rain storm and burned the outside of the building (A0588). On May 21, 1967, a drum of uranium carbide sludge exploded on a truck outside of the building, contaminating asphalt and evaporator equipment. Contamination levels ranged from 300 to 5,000 dpm/100 cm2. Decontamination of the asphalt and equipment was successful (A0615). On May 21, 1967, a 55-gallon drum containing uranium metal under CaCO3 was found burning in the RMHF storage yard. Workers believed the drum was likely to explode, so three rifle shots were fired into the drum to relieve the pressure building inside. The fire was successfully extinguished and the drum was left outside to cool overnight. It was then moved to Building 4021 for storage (A0616). On May 22, 1978, the sump pump stopped working and contaminated liquid flowed out of a holdup tank, contaminating asphalt, which later contaminated eight truck tires placed on the pavement. Both the tires and the asphalt were decontaminated (A0070). On August 14, 1979, a shipping box loaded on a waste truck for offsite disposal leaked radioactive liquid containing Cs-137 and Sr-90 on the asphalt outside RMHF. The area was successfully decontaminated shortly after the incident (A0314). Because of the operational and incident history of this building, as well as the entire RMHF facility, the building and its surroundings will be surveyed and decontaminated at the time of RMHF closure. There have been several surveys of the entire RMHF complex, including Building 4022, during its operation. The results of these surveys are summarized in the 4021 site summary. The entire RMHF facility, including Building 4022, will be surveyed and decontaminated for unrestricted use at the time of RMHF closure. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, H-3
4034	No		I	EU-06	Building 4034, RMDF Office Building, RMHF Office Building. Constructed in 1961, Building 4034 was an office building for RMDF (which was later referred to as RMHF). The facility is active, and serves as the main office and point of entry for RMHF. There are no Use Authorizations and no Incident Reports associated with Building 4034. There have been several surveys of the entire RMHF complex, including Building 4034, during its operation. The results of these surveys are summarized in the 4021 site summary. Routine quarterly radiation surveys are conducted in this office building to verify that it has not become contaminated. (HSA)	None
4044	Yes		I	EU-06	Building 4044, RMDF Clean Shop, RMDF Support Lab, RMHF Support Lab. Constructed in the middle 1960s, Building 4044 has served various purposes throughout the life of the RMDF/RMHF including as a clean shop, health physics offices and as a break room. The facility is active and contains the break room and health physics offices for RMHF. The health physics offices in this building have been used as counting areas for removable contamination measurements and storage and use of calibration sources. No other regulated radiological materials were managed specifically in this building. There have been several surveys of the entire RMHF complex, including Building 4044, during its operation. The results of these surveys are summarized in the 4021 site summary. Routine daily and monthly radiological surveys are conducted in Building 4044 to verify that it has not become contaminated. (HSA)	None
4075	Yes		I	EU-06	Building 4075, RMDF Contaminated Equipment Storage Building, RMHF Contaminated Equipment Storage Building. Constructed in 1971, Building 4075 served as a storage area for radioactive waste prior to shipment to disposal sites. In approximately 2001, the building ceased to be used as a storage area and has since remained unused. Radioactive waste was stored in this building. Possible contaminants include uranium, thorium, plutonium isotopes and mixed fission products. The following is an incident which may have involved a release of contamination to the environment. On August 15, 1988, a forklift driver punctured a drum of radioactive sand. The sand spilled out onto the floor of Building 4075; however, surveys indicated that no detectable contamination occurred as a result (A0188). There have been several surveys of the entire RMHF complex, including Building 4075, during its operation. The results of these surveys are summarized in the 4021 site summary. Routine quarterly radiological surveys are conducted to verify that Building 4075 has not become contaminated above the limits established by 10 CFR 835. (HSA)	U, Th, Pu, mixed fission products
4614	Yes		I	EU-06	Site 4614, RMDF Drainage Sump (removed, replaced with tank), RMHF Drainage Sump, RMHF Holdup Pond. Constructed in the middle 1960s, Site 4614 served as a holdup pond for surface runoff from the RMDF/RMHF facility. Site 4614 is active. Radioactive contamination exists in the pond as a result of known spills that have occurred at the RMDF/RMHF. There have been two notable	Sr-90, Cs-137, mixed fission products

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
					radiological incidents associated with Site 4614. On January 17, 1979, leakage from the flocculation tower associated with Building 4021 contaminated the drainage ditch and the pond itself with less than 0.4 mCi of Sr-90 and Cs-137 (A0077). On January 9, 1980, a water hose broke, causing the Building 4021 tank to overflow, which then drained to the pond. This incident resulted in the released of about 100 gallons of liquid containing 1 x10-2 mCi of mixed fission products (A0080). There have been several surveys of the entire RMHF complex, including Site 4614, during its operation. The results of these surveys are summarized in the 4021 site summary. Due to operational history, Site 4614 is likely contaminated. Site 4614 is monitored and alarmed by a NaI gamma exposure meter. Any alarms result in immediate sampling of the water. All alarms in the past 14 years have been false alarms caused by power supply and telephone line problems during wet weather. No activity has been detected in the water. Water pumped from this pond into the Santa Susana Field Laboratory (SSFL) water reclamation system is ultimately sampled according to the National Pollutant Discharge Elimination System (NPDES) permit. During the dry season when the pond dries up, the sediment is removed from the lined pond and analyzed for contamination prior to being disposed of as radioactive waste. Low levels of Cs-137 are frequently found (e.g. 34 pCi/g in 2003). (HSA)	
4621	Yes		I	EU-06	Building 4621, RMDF Equipment, RMHF Equipment. Constructed in the middle 1960s, Building 4621was used to store contaminated equipment and materials for the RMDF (which later referred to as RMHF). Building 4621 is active. Radioactive material was stored in this facility, primarily in the form of mixed fission products from various site wastes. Use Authorization Series 107 authorized the storage of two Krypton-85 Aerosol Neutralizers at this location. One is specified to contain one µCi and the other two µCi. Both are gaseous and sealed in a Thermo-Systems Model 3012 Neutralizer. An incident occurred at this facility which may have involved a release to the environment. On September 4, 1975, a 132 mCi Ra-266 source was discovered lying on the ground outside Building 4621. The source was not labeled, nor was in it a shielded container. Following its discovery, the source was properly marked and stored in a secure condition (A0053). There have been several surveys of the entire RMHF complex, including Building 4621, during its operation. The results of these surveys are summarized in the 4021 site summary. Routine radiological surveys are conducted in Building 4621 to verify that the building has not become contaminated above the limits established by 10 CFR 835. (HSA)	Mixed fission products
4622	Yes		I	EU-06	Building 4622, RMDF Counting Building. Constructed prior to 1962, Building 4622 was used as a health physics counting area and was demolished in approximately 1976. Health physics samples of waste contained at the RMDF/RMHF facility were counted for radioactivity in this building. There are no Incident Reports associated with Building 4622. There have been several surveys of the entire RMHF complex, including Building 4622, during its operation. The results of these surveys are summarized in the 4021 site summary. During its use, routine radiological surveys were conducted in Building 4622 to verify that the building had not become contaminated above the limits established by DOE Order 5480.11. (HSA)	None
4658	No		I	EU-06	Building 4658, RMDF Guard Shack, RMHF Guard Shack. Constructed in the early 1980s, this building served as a guard shack for the RMDF. The facility's name was later changed to the RMHF. Throughout most of the 1980s, this facility was used as the main entrance point into the RMDF/RMHF facility. In the late 1980s, security measures no longer required the use of the guard shack as an entrance to the facility. The building still remains as an inactive structure. Radioactive materials were not managed specifically in this building, although fuels and wastes were managed at the RMDF/RMHF facility. There are no Incident Reports associated with Building 4658. There have been several surveys of the entire RMHF complex, including Building 4658, during its operation. The results of these surveys are summarized in the 4021 site summary. During its use, routine radiological surveys were conducted in Building 4658 to verify that the building had not become contaminated. (HSA)	None
4663	Yes		I	EU-06	Building 4663, RMDF Storage Area, RMHF Storage Area. Constructed in the late 1950s or early 1960s, Building 4663 was used for storage of materials. Demolished in the early 1970s; however, the remaining concrete pad serves as a storage area for non-radioactive material. Radioactive waste may have been stored at this facility. The most probable contaminants of concern are uranium, plutonium, thorium isotopes and mixed fission products. There are no Incident Reports associated with Building 4663. There have been several surveys of the entire RMHF complex, including Building 4663, during its operation. The results of these surveys are summarized in the 4021 site summary. During its use, routine radiological surveys were conducted in Building 4663 to verify that the building had not become contaminated above the limits established by DOE Order 5480.11. (HSA)	U, Pu, Th, mixed fission products
4664	Yes		I	EU-06	Building 4664, RMDF Low Level Waste Processing. Constructed in the middle 1960s, Building 4664 was used as a processing facility for low-level radioactive waste at the RMDF (which was later named RMHF). Demolished in the early 1980s. Radioactive waste and material were most likely stored or handled at this facility. The most probable contaminants of concern are uranium, plutonium, thorium isotopes and mixed fission products. The following is an incident which may have involved a release of contamination to the environment. On February 10, 1965, the evaporator system backed up and a flexible hose was blown from its connection, releasing approximately five gallons of radioactive contaminated liquid onto the asphalt. Decontamination of this area was performed immediately (A0362). There have been several surveys of the entire RMHF complex, including Building 4664, during its operation. The results of these surveys are summarized in the 4021 site summary. During its use, routine radiological surveys were conducted in Building 4664 to verify that the building had not become contaminated above the limits established by DOE Order 5480.11. (HSA)	U, Pu, Th, mixed fission products
4665	Yes		I	EU-06	Building 4665, RMDF Oxidation Facility, RMHF Equipment Storage. Constructed in the middle 1960s, Building 4665 was used as an oxidation facility for the RMDF (later renamed the RMHF). Building 4665 is still active as a non-radioactive storage area. Radioactive waste and material may have been stored or handled at this facility. The most probable contaminants of concern are uranium, plutonium, thorium isotopes, and mixed fission products. There are no Incident Reports associated with Building 4665. There have been several surveys of the entire RMHF complex, including Building 4665, during its operation. The results of these surveys are summarized in the 4021 site summary. Routine quarterly radiological surveys are conducted in Building 4665 to verify that it has not become contaminated. (HSA)	U, Pu, Th, mixed fission products
4688	Yes		I	EU-06	Building 4688, Auxiliary Skid Shack, RMDF Storage, RMHF Storage. Constructed in approximately 1962. Building 4688 was located northeast of the SRE complex. After 1962, Building 4688 no longer appears in this location. In 1967, a structure referred to as Building 4688 appears on an Industrial Planning Map in the RMHF complex. It is unclear whether the original structure was transferred to the second location or a new structure was built. Although no documentation exists on the building, its location indicates that it was likely used to support sodium cleaning activities at Building 4723. In the middle 1960s, this structure was moved to the RMHF complex and began use as a storage area, possibly for radioactive materials. This structure is currently active as a non-radioactive storage area. Radioactive material may have been stored under this structure. There are no Use Authorizations and no Incident Reports associated with Building 4688. There have been several surveys of the entire RMHF complex, including Building 4688, during its operation. The results of these surveys are summarized in the 4021 site summary. Building 4688 is included in routine quarterly radiological surveys of the RMHF. (HSA)	None
4023	Yes		J	EU-06	Building 4023 Liquid Metals Component Test Building, Corrosion Test Loop Includes Building 4742, Substation. The first section of Building 4023, constructed in 1962 (known as 023), housed a small sodium loop to conduct studies of radioactive contamination transport. The second section, constructed in 1976 (known as 23A), served as a storage and setup room as well as an analytical chemistry laboratory. In 1982, an Alnor Dew-Point Meter containing a 6.25 µCi Ra-226 source was brought to the facility to be disassembled, but the disassembly was never authorized or attempted and the instrument was removed intact in 1986. A 10 µCi Mn-54 sealed source, which was checked annually to ensure that no leaks had occurred, was stored in the building from 1983 to 1986. Sodium loop tests stopped in 1982 and the loop was dismantled and removed in 1986. At this point the connections to the tank were sealed and sinks were removed. In 1990 the high-efficiency particulate air (HEPA) filtration system and fume hoods were removed. The remainder of the radioactive liquid waste system (pipes, drains, tank) was removed in 1993. The majority of the contamination of Building 4023 was associated with drain lines and associated vent pipes, the holdup tank, the open top holdup tank pit, and a laboratory fume hood. The contaminants of concern associated with the activities at Building 4023 include: Co-60, Mn-54, Ni-63, Fe-55, Ta-182 and tritium. Limited amounts of Cs-137 and Sr-90 were also found. Use Authorization 105 was issued in 1976. It allowed the use of a small section of activated stainless steel Experimental Boilers Reactor fuel cladding in a small sodium test loop to gather data on transport characteristics of radiological contamination in sodium loops. There have been two incidents associated with Building 4023 that could have resulted in a release to the environment. On December 18, 1980, water reacted with non-neutralized sodium and surged out of the loop. The water leak resulted in contamination of the ceiling, walls and floor with maximum contamination levels of 1,000 dpm/100 cm2 of Mn-54 (A0084). On April 28, 1981, there was a minor sodium leak and fire, with Cs-137, Mn-54 and Co-60 as the principal radioactive isotopes contained in the loop at the time. The fire was extinguished with calcium carbonate. Smears of the loop and the floor showed no radioactive contamination (A0257). All drain lines in Building 4023 were connected to the waste holdup tank system. The lines were both above and below ground. In 1993, Rockwell/Rocketdyne conducted a final radiological survey to ensure compliance with acceptable contamination limits for activation products and mixed fission products and for ambient exposure rate. The scope of the survey included only the interior rooms of the building. Contamination limit criteria are as follows: For alpha and beta contamination: • Average contamination of ≤ 5,000 dpm/100 cm2. • Maximum of contamination ≤ 15,000 dpm/100 cm2. • Removable contamination of ≤ 1,000 dpm/100 cm2. For gamma contamination: • ≤ 5 µR/hr above background at 1 meter interior and exterior. Initial surface scans indicated an area within Building 4023 with elevated levels of Cs-137 requiring additional contamination. These locations were decontaminated and post-remedial action scans found surface activity to be below release limits. Observed detection limit ranges are as follows: Removable alpha: 2 dpm/100 cm2 to 9 dpm/100 cm2. Total beta: 252 dpm/100 cm2 to 373 dpm/100 cm2. Removable beta: 6 dpm/100 cm2 to 23 dpm/cm2. Net ambient gamma exposure rate: 0.49 µR/hr to 0.66 µR/hr. In 1994, ORISE conducted a verification survey using surface scans to confirm that remedial actions	Sr-90, Cs-137, Co-60, Eu-152, Eu-154

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
					have been effective in meeting established guidelines. No soil samples were taken, because the entire area around Building 4023 was paved. Scans inside the Building 4023 Control Room identified elevated direct radiation in two areas that required additional investigation. Rocketdyne personnel decontaminated the two areas and Environmental Survey and Site Assessment Program (ESSAP) personnel performed additional scans after the decontamination. Scans showed the beta surface activity was comparable to background levels. Final survey results for total surface activity levels inside Building 4023 were less than 66 to 400 dpm/100 cm2 for alpha and less that 1,400 to 6,700 dpm/100 cm2 for beta. Final survey results for activity levels on exterior surfaces, including the holdup waste tank vault, were less than 66 dpm/100 cm2 to 120 dpm/100 cm2 for alpha and less than 1,500 dpm/100 cm2 to 1,600 dpm/cm2 for beta. On August 28, 1997, the Radiological Health Branch (RHB) and the California Department of Health Services (DHS) conducted a confirmatory survey of Building 4023. A complete qualitative gamma scan of the facility and surrounding area was performed. Selected measurements of total and removable beta surface activity and local gamma exposure rates were also conducted. The survey results and laboratory analysis results confirmed the results of the final radiological survey in 1993 and the Oak Ridge Institute for Science and Education (ORISE) verification survey in 1994. (HSA)	
4024	Yes		J	EU-06	Building 4024 - S2DR, S10FS, SNAP Transient Test Facility Development Test Laboratory Systems for Nuclear Auxiliary Power (SNAP) Environmental Test Facility (SETF) Includes Building 4928, Cooling Tower Includes Building 4725, Substation. Constructed in 1960, Building 4024 was used for testing SNAP reactors in a simulated operational environment. It was enlarged in 1962 to provide a second control room and increased operating equipment area. Prototype reactor SNAP 2 Demonstration Reactor (S2DR) operated for 5,000 hours at 30 and 50 kWt in the east cell between April 1961 and December 1962. Prototype SNAP 10 Flight System (S10FS-3) reactor operated for 10,000 hours at about 40 kWt in the west cell between January 1965 and March 1966. SNAP Critical Assembly 4B, operated in the east cell for a short time at low power. SNAP Transient Test (SNAPTRAN-1) support reactor, also critical, operated in the east cell for a short time. Typically SNAPTRAN-1 was operated at low power, except for some pulsed operation. This reactor last operated in 1971. It was the last reactor to be tested in Building 4024. Potential radiological hazards are limited to the high bay area (including cell complex), electrical/mechanical support and yard areas. Two general areas of concern in the high bay are the cells and the S10FS-3 reactor support equipment room. The electrical/mechanical support area contains systems for gas and exhaust filtering, shield cooling water and a vacuum cleaner, all of which are potentially contaminated. As a result of exposure to neutrons escaping from the two operating reactors, the walls, ceiling, floor and remote handling equipment of the test cells were activated. There have been several incidents associated with Building 4024 that could have resulted in a release to the environment. On March 6, 1962, a welder was burned with NaK in the high bay (A0535). On February 19, 1970, maintenance workers unknowingly worked on contaminated general mills (A0634). In September 1978, prior to partial unrestricted release, surveys were conducted to ensure that the facility met unrestricted release criteria. No contamination in excess of 50 dpm/100 cm2 was found. No alpha activity was detected anywhere in Building 4024. Beta-gamma surface contamination limits were 0.1 mrad/hr, and the maximum beta-gamma surface contamination detected outside of the power vaults was 0.07 mrad/hr with an average background of 0.05 mrad/hr. Inside the power vaults, beta-gamma surface contamination was found to range from 0.5 mrad/hr to 2.5 mrad/hr. Inside the corridor to the power vaults, beta-gamma surface contamination ranged from 0.02 mrad/hr to 1.8 mrad/hr. Soil samples were collected in the yard and all samples were less than 30 pCi/g. Background is 20-30 pCi/g. Concrete cores drilled in the power vault walls and corridor were found to have a maximum specific activity of 818 pCi/g. The average specific activity was 103 pCi/g. All water samples from the drain pipe in the operating gallery, the hot waste storage vault, cooling system water waste holdup tanks, ground water during the removal of waste tanks and the vacuum cleaning line to the west power vault were below 2.2 x 10-7 µCi/ml, which is below the limit of 3 x 10-7 µCi/ml for Sr-90. On March 26, 1981, additional concrete sampling in the power vaults began to determine the amount of concrete they needed to remove to meet unrestricted release criteria. The survey indicated that 12 to 22 inches of concrete would need to be removed for surface radiation to meet the acceptable dose rate of 0.1 mrad/hr. Only two radionuclides, Co-60 and Eu-152, were found to contribute significantly to radiation greater than background. In September 1995, ORISE Conducted an independent verification survey. Surface scans were performed over 50 to 100% of accessible floors and lower walls (up to 2 meters) for alpha, beta and gamma activity. In the fan room, elevated direct beta radiation was identified. In all other areas, alpha, beta and gamma radiation were within the range of ambient site background. Surface activity measurements were conducted at 76 floor and wall locations. Excluding the power vaults, surface activity levels were less than 55 dpm/100 cm2 for alpha and ranged from less than 1,400 to 33,000 dpm/100 cm2 for beta. Removable alpha: less than 12 dpm/100 cm2. Removable beta: less than 16 dpm/100 cm2. Maximum beta-gamma total surface activity guideline (15,000 dpm/100 cm2) was exceeded in the hot gas compression room of Building 4024. Exposure rate measurements were made at four locations in Building 4024, but none were made in the power vaults. Excluding the power vaults, exposure rates ranged from 11 to 13 µR/hr. Background was 8 µR/hr. Interior exposure rates satisfy Department of Energy (DOE) and Nuclear Regulatory Commission (NRC) exposure rate guidelines. ORISE determined that existing documentation for Building 4024 was inadequate to support the determination that DOE guidelines for unrestricted release were met. Additional concrete core data taken in 2003 indicates activation with a maximum of 9.3 pCi/g of Co-60 and a maximum of 105 pCi/g of Eu-152. Measurable activation exists only within the inner 16 inches of concrete of the two power test cells. The power test vaults are restricted and have remained in surveillance and maintenance mode since September 1, 1978. Additional decontamination of Building 4024 is planned for FY 2004. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, H-3
4027	No		J	EU-06	Building 4027, SNAP Engineering Development Laboratory, Former Weld Shop, SNAP Vibration and Shock Laboratory Includes Building 4727, Substation. Constructed in 1961, Building 4027 was used as a vibration and shock test facility in support of the SNAP program launch schedule. Following the end of support work for SNAP tests, Building 4027 was used as a nonradiological storage facility. Building 4027 was demolished in 2003. There are no Use Authorizations associated with Building 4027. No incidents occurred in Building 4027 that might have resulted in a release of contamination to the environment. Building 4027 may have been used for storing sealed radiography sources, which would have been checked annually to ensure that no leaks had occurred. As part of the DOE SSFL Site Survey, Building 4027 was surveyed to determine if any residual activity was accidentally left behind as a result of operations in support of the SNAP program. The high bay and storage portions of Building 4027 were surveyed as separate units due to variations in “ambient background.” o High Bay Maximum net gamma: 3.8 µR/hr (corrected for background and statistically tested against an acceptance limit of 5 µR/hr). Average net gamma: 0.46 µR/hr. Based on the median value of exposure rate measurements in the vicinity of Building 4027, the ambient background value for gross gamma was determined to be 9.09 µR/hr. All beta surface activity measurements made “for indication” showed no detectable activity. Based on the results of the interior survey of Building 4027, the conclusion was made that this area passes the criteria for unrestricted use. Storage Maximum net gamma: 2.8 µR/hr (corrected for background and statistically tested against an acceptance limit of 5µR/hr). Average net gamma: –1.26 µR/hr. Based on the median value of exposure rate measurements in the vicinity of Building 4027, the ambient background value for gross gamma was determined to be 17.40 µR/hr. All beta surface activity measurements made “for indication” showed no detectable activity. Based on the results of the exterior survey of Building 4027 and the storage yard, the conclusion was made that this area is not contaminated and passes the criteria for unrestricted use. (HSA)	None
4032	Yes		J	EU-06	Building 4032 Liquid Metal Development Lab (LMDL), Space Environmental Test Facility, Includes Building 4727, Substation. Constructed in 1962, Building 4032 was used as a space environmental test facility for a thermal vacuum system. Building 4032 was used for mock-ups using a radiological source to determine the positioning of non-radioactive rods for use in developing the fuel rod control system. After support work for SNAP tests ceased, Building 4032 was used as a sodium component and instrumentation test facility. Demolished in May 2003. From 1978 through 1983, Building 4032 was used for mock-ups using a radiological source to determine the positioning of non-radioactive rods for use in developing the fuel rod control system. During these experiments, under Use Authorization 118, a radiation source was used to determine the location, free fall time and acceleration of the articulated rod assembly of the Self Actuated Shutdown System-Articulated Control Assembly (SASS-ACA) test article. The source was 97.2 µCi of Co-60. The form was sealed source S/N 43014, which was checked annually to ensure no leakage occurred. During the 1988 beta survey, a stainless steel catch pan was found to be slightly contaminated with Co-60 at a level of about 25,000 dpm/100 cm2. The catchpan was most likely from Building 4059 or related to the SNAP facility and ended up in Building 4032 accidentally. The radioactivity was fixed in the steel and did not spread to surrounding areas. The pan was dispositioned as radioactive waste. As part of the DOE SSFL Site Survey, Building 4032 was surveyed to determine if any residual activity was accidentally left behind as a result of operations in support of the SNAP program. The maximum gamma exposure rate (corrected for background and statistically tested against an acceptance limit of 5 µR/hr) in Building 4032 was 4.4 µR/hr. The average value was 0.43 µR/hr. Based on the median value of exposure rate measurements in the vicinity of Building 4032, the ambient background value for gamma was determined to be 7.27 µR/hr. All beta surface activity measurements made “for indication” showed no detectable activity, except for the stainless steel catch pan described above. Based on the results of the survey of Building 4032, the conclusion was made that this area passes the criteria for unrestricted use. (HSA)	
4037	No		J	EU-06	See 4036	See 4036
4042	Yes		J	EU-06	Building 4042 Liquid Metal Fast Breeder Reactor (LMFBR) Development Testing, SNAP Shield Casting Facility, Includes Building 4742, Substation. Constructed in 1963, Building 4042 was used as a general test and lithium hybrid shield fabrication building in support of the SNAP program. The facility was also used for sodium-aerosol and related technology tests. After support work for SNAP tests ceased, Building 4042 was used for liquid metal technology work. Demolished in May 2003. Use Authorization 62 was obtained for a period of one year, from February 6, 1973, to February 6, 1974. The authorization was for 15,000 lbs of uranium in the form of UO2 powder for the Lower Axial Blanket Shielding Experiment. It is unclear whether this experiment was ever conducted. In the Site Survey	None

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
					Plan, Building 4042 was incorrectly listed as having a contaminated sodium test loop. This test loop was actually in Building 4023. As part of the DOE SSFL Site Survey, Building 4042 was surveyed to determine if any residual activity was accidentally left behind as a result of operations in support of the SNAP program. Measurements, including exposure rate measurements, were made in Building 4042. Maximum gamma: 4.4 µR/hr. (corrected for background and statistically tested against an acceptance limit of 5 µR/hr). Average gamma: 0.1 µR/hr. Based on the median value of exposure rate measurements in the vicinity of 4042, the ambient background value for gamma was determined to be 7.1 µR/hr. Maximum total-average alpha: 12.6 dpm/100 cm2 (statistically tested against an acceptance limit of 5,000 dpm/100 cm2). Average total-average alpha: 4.0 dpm/100cm2. Maximum removable alpha: 5.9 dpm/100 cm2 (statistically tested against an acceptance limit of 1,000 dpm/100 cm2). Average removable alpha: 0.5 dpm/100cm2. Maximum total-average beta: 1,200 dpm/100 cm2 (statistically tested against an acceptance limit of 5,000 dpm/100 cm2). Average total-average beta: 775 dpm/100cm2. Maximum removable beta: 15.4 dpm/100 cm2 (statistically tested against an acceptance limit of 1,000 dpm/100 cm2). Average removable beta: 2.8 dpm/100cm2. Based on the results of the survey of Building 4042, the conclusion was made that this area passes the criteria for unrestricted use. (HSA)	
4524	No		J	EU-06	Site 4524 Parking Lot. Constructed prior to 1962, Site 4524 served as a parking lot for personnel working in the SNAP area. Demolished in the middle 1960s.There are no Use Authorizations and no Incident Reports associated with Site 4524. Radiological surveys specific to Site 4524 have not been conducted. This area was covered as part of the 1994-1995 Area IV Radiological Characterization Survey. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. Survey results were below the acceptable limits. (HSA)	None
4536	No		J	EU-06	Site 4536 Parking Lot Includes Building 4836, Time Clock Includes Building 4636, Guard Shack. Constructed prior to 1962, Site 4536 was a parking lot for personnel working in the SNAP facility. Site 4536 is now used for storage of non-radiological equipment. There are no Use Authorizations and no Incident Reports associated with Site 4536. Radiological surveys specific to Site 4536 have not been conducted. This site was included in the Area IV Radiological Characterization Survey, conducted in 1994 through 1995. Scope/Purpose: Designed to locate and characterize any previously unknown areas of elevated radioactivity in Area IV. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. The survey found the area to be below acceptable limits. (HSA)	None
4537	No		J	EU-06	Site 4537 Parking Lot. Constructed prior to 1962, Site 4537 served as a parking lot for personnel working in the SNAP facility. Site 4537 is now used for storage of non-radiological equipment. There are no Use Authorizations and no Incident Reports associated with Site 4537. Radiological surveys specific to Site 4537 have not been conducted. This site was included in the Area IV Radiological Characterization Survey, conducted in 1994 through 1995. Scope/Purpose: Designed to locate and characterize any previously unknown areas of elevated radioactivity in Area IV. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. The survey found the area to be below acceptable limits. (HSA)	None
4625	No		J	EU-06	Building 4625 Non-Nuclear Component Storage Building. Constructed in approximately 1961, Building 4625 operated as a Non-Nuclear Component Storage Building. In 1964, an addition was built onto the adjacent Building 4027, filling the gap between Building 4027 and Building 4625. From that point on, Building 4625 was considered part of Building 4027 and no longer referred to separately. Building 4027 was built in 1961, and was used as a vibration and shock test facility in support of the SNAP program launch schedule. There is no record of any activities conducted in Building 4027 involving radioactive or nuclear materials, although Building 4027 may have been used for storing completely sealed radiography sources. After support work for SNAP tests ceased, Building 4027 was used as storage facility. Building 4625 was demolished in 2003. Building 4625/4027 is located in close proximity to RMHF; therefore, direct radiation and skyshine from RMHF affects ambient radiation conditions in the area. There are no Use Authorizations and no Incident Reports associated with Building 4625/4027. As part of the DOE SSFL Site Survey, Building 4625/4027 was surveyed to determine if any residual activity was accidentally left behind as a result of operations in support of the SNAP program. The high bay and storage portions of Building 4625/4027 were surveyed as separate units due to variations in ambient background. High Bay: Maximum net gamma: 3.8 µR/hr (corrected for background and statistically tested against an acceptance limit of 5 µR/hr). Average net gamma: 0.46 µR/hr. Based on the median value of exposure rate measurements in the vicinity of 4625/4027, the ambient background value for gross gamma was determined to be 9.09 µR/hr. All beta surface activity measurements made “for indication” showed no detectable activity. Based on the results of the interior survey of Building 4625/4027, the conclusion was made that this area passes the criteria for unrestricted use. Storage Maximum net gamma: 2.8 µR/hr (corrected for background and statistically tested against an acceptance limit of 5µR/hr). Average net gamma: –1.26 µR/hr. Based on the median value of exposure rate measurements in the vicinity of 4625/4027, the ambient background value for gross gamma was determined to be 17.40 µR/hr. All beta surface activity measurements made “for indication” showed no detectable activity. Based on the results of the exterior survey of Building 4625/4027 and the storage yard, the conclusion was made that this area is not contaminated and passes the criteria for unrestricted use. (HSA)	None
4636	No	4536	J	EU-06	See 4536	See 4536
4725	No	Building 4024, 4025	J	EU-06	See 4024, 4025	See 4024, 4025
4727	No	Building 4027, 4032, 4036, 4037	J	EU-06	See 4027, 4032, 4036, 4037	See 4027, 4032, 4036, 4037
4742	No	Building 4042	J	EU-06	See 4023, 4042	See 4023, 4042
4836	No	4536	J	EU-06	See 4536	See 4536
4924	No	4025	J	EU-06	See 4025	See 4025
4925	No	4025	J	EU-06	See 4025	See 4025
4926	No	4025	J	EU-06	See 4025	See 4025
4927	No		J	EU-06	Building 4927 Nitrogen Storage Tank. Constructed prior to 1962, Building 4927 was most likely demolished in the 1970s, when the site began using a high-pressure nitrogen system. This involved piping in nitrogen from Area III, eliminating the need for most Area IV nitrogen storage tanks. Building 4927 was used to store nitrogen. Documents outlining which buildings the storage tank serviced could not be located; however, the Facility Area Plan of inert gas shows that the adjacent Building 4025 was serviced by high-pressure nitrogen system. Before the system was installed, Building 4927 most likely serviced Building 4025. There are no Use Authorizations and no Incident Reports associated with Building 4927. Radiological surveys specific to Building 4927 have not been conducted. This site was included in the Area IV Radiological Characterization Survey, conducted in 1994 through 1995. Scope/Purpose: Designed to locate and characterize any previously unknown areas of elevated radioactivity in Area IV. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. The survey found the area to be below acceptable limits. (HSA)	None
4928	Yes	4024	J	EU-06	See 4024	See 4024
4028	Yes		K	EU-06	STR, STIR, LMFBR; Facility constructed to perform test on space reactor shields. Site 4811 became part of Building 4028 in the mid-60's and was a mechanical and electrical pad that held equipment directly supporting the STIR facility reactor. After STIR was decommissioned, Building 4028 was used to conduct research on the behavior of molten UO2. D&D conducted in 1988. Five incident associated with Building 4028 that could have resulted in a release to the environment. On July 17, 1963, an unmarked irradiated fission foil was moved in a private car to a clean office. On June 17, 1965, an employee received an extremity beta exposure resulting from the handling of a plastic bag sealed with green tape containing chemical samples which were irradiated for 1000 seconds at 1 Mw. On January 10, 1978, there was a small Uranium fire in the arc-melting furnace. On January 30, 1979, increased radioactivity was found in runoff water from Radioactive Materials Disposal Facility. The estimated total activity released to the pond was approximately 0.36 mCi of gross beta activity. On July 24, 1981, a contaminated crucible stored outside was exposed to elements. A site water runoff analysis was conducted as part of the D&D effort. It determined that there was no detectable activity. Additional surveys indicated results were below acceptable limits. DHS performed verification sampling in 1992. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, H-3
4504	No		K	EU-06	Classified Scrap and Salvageable Steel (SS) Material Storage Area used to store classified scrap and SS. There are no incidents that could have resulted in releases to the environment associated with Building 4504. A final survey of the total facility conducted in 1988 after D&D was completed verified contamination levels were below acceptable limits. (HSA)	
4811	No	4028	K	EU-06	See 4028	See 4028

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4048	No		N	EU-06	Plant Development Unit (PDU) Instrumentation facility. There are no Use Authorizations and no Incident Reports associated with Building 4048. Radiological surveys specific to Building 4048 have not been conducted. (HSA)	None
4049	Yes		N	EU-06	Building 4049 was used as a control center in the 1950s and 1960s to support the Systems for Nuclear Auxiliary Power (SNAP) Program. Beginning in 1960, Building 4049 was used as a hydraulic test facility control center. The outside test stand was used for tests with terphenyl organics and finned sinteredaluminum-product cladding materials, sodium-water reaction tests and a variety of sodium and NaK hydraulic tests. From 1968 to 1977, Building 4049 was used as a control center for Piqua Test Loops. In 1977, Building 4049 was designated as a control and test center for the PDU coal gasification process. By 1988, Building 4049 was secured and inactive. Demolished in 1999. Several incidents occurred in Building 4049 which could have resulted in a release to the environment. On March 31, 1960, a pipe containing High Boiler Residue (HBR) was opened, with HBR spilling onto someone's shoes and pant legs. Activated corrosion product (ACP) contamination levels were recorded at 500 dpm/100cm2. An incident occurred on April 1, 1960, during which an employee came in contact with a pipe containing a residue of HBR. It was not considered necessary to measure ACP contamination levels. Due to its proximity to Building 4005 which was known to be contaminated in certain locations, Building 4049 was included in the DOE SSFL Site Survey in 1988. Based on the results the Building 4049 was judged to be uncontaminated. (HSA)	None
4005	Yes		O	EU-06	Uranium Carbide Fuel Pilot Plant. Building 4005 was constructed for non-nuclear testing of thermodynamic characteristics of proposed coolants for the Organic Moderated Reactor Experiment and Piqua reactors. During the middle 1960s, Building 4005 was converted into a small-scale production facility to study the operations associated with manufacturing reactor fuel assemblies out of uranium carbide. The facility operated for a period of nine months during 1966-1967, first using depleted uranium, and later enriched uranium. In 1967, equipment was removed and surfaces decontaminated to permit nonradiological use of the building. Beginning in 1972, Building 4005 was used as the Molten Salt Test Facility, a nonnuclear test facility consisting of the Molten Salt Test Bed and the Process Demonstration Unit. Completion of removal of contaminated systems was completed in 1993. Previous decontamination efforts in the late 1970s involved removal of the underground radioactive liquid holdup tanks outside the building. The drain lines from the buildings were capped and left in place. The drain lines were removed during another decontamination effort in 1987. Demolished in 1996. Radioactive material in the form of depleted and enriched uranium was managed at this facility. Accordingly, the contaminant of concern for Building 4005 is uranium. During operation as the Uranium Carbide Fuel Pilot Plant, considerable difficulties were experienced with the air exhaust system scrubbers and filters, including a fire in 1967. Radiological contamination was restricted to the exhaust ducts. There have been several incidents associated with Building 4005 that could have resulted in a release to the environment. In January 30, 1967, a uranium fire occurred in a retention tank of a vacuum system. Tank ducting was burned through, allowing a release of contaminated smoke to the building. No release outside the building was thought to have occurred. On August 8, 1991, contaminated oil dripped from a radioactive exhaust duct, contaminating a concrete pad. The total activity for the spill was approximately 4 nCi, and all contamination was successfully cleaned up. Building 4005 was connected to a sanitary leach field by drain lines that extended from various laboratories and work areas in the building to two underground holding tanks. The leach field was disconnected and abandoned in 1960-61, when the Santa Susana Field Laboratory (SSFL) sewer treatment plant was constructed. It is not likely that the leach field, septic tanks and drain lines were impacted by radiological constituents because work involving regulated radiological materials did not begin until 1966. The drain lines and tanks were removed in 2001 at the same time the septic tanks were removed. Sampling of soil under drain lines, leach fields and septic tanks did not detect any contamination. Rocketdyne performed a characterization survey in 1987 to confirm that residual contamination remained in ventilation systems and drain lines. The survey showed that several areas were contaminated at levels above Department of Energy (DOE) release limits: room 113, room 110E, four remaining radioactive exhaust ducts and both radioactive exhaust filter plenums. Maximum beta levels: 107,954 dpm/100cm2 for the rooms (Acceptable limit is 1,000 dpm/100cm2). Maximum alpha levels: 2,467 dpm/100cm2 (Acceptable limit 1000 dpm/100cm2). Maximum beta levels: 6,302 dpm/100cm2 in the exhaust ducts (Acceptable limit 1000 dpm/100cm2). No other residual contamination was present. • Rocketdyne performed a final survey in September 1993. Derived concentration guideline levels (DCGLs) for soil were as follows: U-234 < 23.17 pCi/g (total). U-235 < 5.54 pCi/g (total). U-238 < 24.55 pCi/g (total). The survey found that Building 4005 and adjacent yards were acceptably free of contamination and recommended that the facility be released for unrestricted use. • Oak Ridge Institute for Science and Education (ORISE) and the California Department of Health Services (DHS) performed verification surveys in 1994. (HSA)	U-234, U-235, U-238
4705	No	4005	O	EU-06	See 4005	See 4005
4036	No		J	EU-06 & EU-04	Building 4036/4037, SNAP Office Buildings Includes Building 4727, Substation. Constructed in approximately 1962, Building 4037 appears distinctly only on the 1962 map. Thereafter, it is labeled as part of Building 4036. Building 4036/4037 operated as a non-nuclear office building for the SNAP program. Demolished in 1999. There are no Use Authorizations and no Incident Reports associated with Building 4036. Building 4036 did not require radiological controls during demolition. Radiological surveys specific to Building 4036 have not been conducted. (HSA)	None
4025	No		J	EU-06 & EU-08	Building 4025 Sodium Component Test Installation (SCTI) Maintenance and Storage, Remote Handling Mock-up Facility, Includes Building 4924, Substation; Includes Building 4925, Mechanical Equipment Slab; Includes Building 4926, Sodium Reactor Experiment (SRE) Mock-up Equipment Area; Includes Building 4725, Substation for 4024 and 4025. Constructed in 1959, Building 4025 was used for nuclear reactor remote handling and viewing mock-up work in support of the SNAP 2/10A and SNAP 8 tests. Building 4025 was not known to contain radioactive or nuclear materials. After support work for SNAP tests ceased, Building 4025 was used as a storage and warehouse facility. Demolished in September 1999. Building 4025 was located in close proximity to Radioactive Materials Handling Facility (RMHF), and direct radiation and skyshine from RMHF affected ambient radiation conditions in the area. An incident occurred on January 16, 1979, in which a radiograph operator's dosimeter read off-scale during gradiograph operation, indicating a potential personnel exposure. The radiograph operator's assistant was present at the time, and his dosimeter gave a normal reading. After processing of the off-scale dosimeter, it was determined that the operator had not been exposed to an unacceptable dose. No cause for the off-scale reading was determined (A0306). As part of the Department of Energy (DOE) Santa Susana Field Laboratory (SSFL) Site Survey, Building 4025 was surveyed to determine if any residual activity was accidentally left behind as a result of operations in support of the SNAP program. The inside and outside portions of Building 4025 were surveyed as separate units. Inside: Maximum net gamma: 3.6 µR/hr (corrected for background and statistically tested against an acceptance limit of 5µR/hr). Average net gamma: –0.43 µR/hr (corrected for background). Based on the median value of exposure rate measurements in the vicinity of 4025, the inside ambient background value for gross gamma was determined to be 11.8 µR/hr. All beta surface activity measurements made "for indication" showed no detectable activity. Based on the results of the interior survey of Building 4025, the conclusion was made that this area passed the criteria for unrestricted use. Outside: Maximum net gamma: 3.9 µR/hr (corrected for background and statistically tested against an acceptance limit of 5µR/hr). Average net gamma: –0.14 µR/hr. Based on the median value of exposure rate measurements in the vicinity of 4025, the outside ambient background value for gross gamma was determined to be 24.0 µR/hr. Based on the results of the exterior survey of Building 4025 and the storage yard, the conclusion was made that this area was not contaminated and passed the criteria for unrestricted use. (HSA)	None
4007	No		Q	EU-07	Building 4007, Sodium Storage Building. Constructed in 1958, Building 4007 was used for non-radiological hazardous materials storage. It was demolished in 1996. There are no Use Authorizations and no Incident Reports associated with Building 4007. Radiological surveys specific to Building 4007 have not been conducted. (HSA)	None
4008	No		Q	EU-07	Building 4008, Flammable Material Storage Building. Constructed in 1958, Building 4008 was used for storage of non-radiological flammable materials. It was demolished in 1996. There are no Use Authorizations and no Incident Reports associated with Building 4008. Radiological surveys specific to Building 4008 have not been conducted. (HSA)	None
4011	Yes		R	EU-07	Radiation Instrument, Calibration Laboratory, Building 4011: Warehouse Support, Administration and Services Building, Development Support Shop, Manufacturing Support Shop, Machine Shop/QA., Radiation Instrument Calibration Laboratory, Includes Building 4403, Traffic Dispatch Includes Building 4711, Substation. Constructed in 1958, Building 4011 was used to support various non-nuclear programs until 1984. From 1984 to 1996 the north section of the building was used for calibration and repair of radiation instrumentation. The Property Inventory and Control Department used the south section of the building. Building 4011 is currently used to house communications equipment. Radioactive sources for calibration were handled at the facility but most were sealed and checked annually to ensure no leakage occurred. The potential contaminants of concern are Cs-137, Co-60, Sr-90, Eu-152, Eu-154, thorium and uranium. There were three Radiological Incidents associated with Building 4011 that could have resulted in a release to the environment. On April 28, 1960, to the west of the building, an Organic Moderated Reactor Experiment (OMRE) shipping cask leaked during a leak test and spilled radioactive liquid on the ground (mixed fission products) (A0531). On April 13, 1985, a calibration source came loose from an actuator rod resulting in an exposure of Cs-137. A radiation survey indicated no contamination on any part of the rod (A0318). On December 6, 1994, the 28 Ci Cs-137 calibration source dislocated from the release pull rod. A radiation survey indicated normal background levels in the source containment box and on the release pull rod (A0658). Following removal of the septic tank, field line, tank, tank sludge, and the soils surrounding the tank, samples for gamma emitting radionuclides were collected and the remaining soil was found to be clean. In 1988, the lot across the street from the building was surveyed because it was often used as a dumpsite for dirt and had the potential for contamination. The field was surveyed for mixed fission products by measuring ambient gamma exposure rates. Ambient gamma limit: < 5 µR/hr above background (background was 15.3 µR/hr). Maximum ambient gamma exposure rate: 13 µR/hr. Survey results were below the acceptable limits. A soil sample collected at the northwest corner of the building during the 1996 Area IV Radiological Characterization Survey found elevated Cs-137. The level was 0.53 pCi/g. In 1998, Rocketdyne performed a final comprehensive radiological survey to measure total or	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
					removable surface activity on the walls, floors, ceilings, structural surfaces, concrete pads, sink traps and the roof. The walls, floors and ceilings were surveyed for total and removable alpha and beta activity and maximum alpha and beta activity. Floors were surveyed for ambient gamma readings in µR/hr at one meter. The limit criteria for surface contamination of alpha and beta-gamma emitters was (in dpm/100cm2). Sr-90, Th-natural, Th-232: <1,000 total and <200 removable; U-natural, U-235, U-238, and associated decay products: <5,000 total and <1,000 removable. Beta-gamma emitters: <5,000 total and <1,000 removable. Samples were collected from sludge in the sink traps for gamma spectroscopy analyses. The sludge was contaminated with low levels of uranium and the sink and trap were removed and disposed. An additional sludge sample was taken from a location several feet into the line and the sample met release criteria. Ambient gamma limit: <5.0 µR/hr at one meter from the surface. Survey results were below the acceptable limits. The California Department of Health Services (DHS) performed verification surveys in 1998 and concurred that the facility met release criteria. The Environmental Protection Agency (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 the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The contaminants of concern (COCs) for Building 4011 were mixed fission products, uranium, transuranic compounds, and activation and corrosion products. EPA also collected concrete core samples which were analyzed for photon-emitting isotopes. Acceptable limits for the survey were consistent with Nuclear Regulatory Commission (NRC) Regulatory Guide 1.86 and the proposed sitewide release criteria. Survey results were below the acceptable limits. EPA field measurements confirmed the conclusions reached by Rocketdyne. (HSA)	
4171	No		R	EU-07	Building 4171, X-Ray Building. Constructed in the middle 1960s, Building 4171 was used for storage of miscellaneous electronic equipment. It was demolished in 2000. There are no Use Authorizations and no Incident Reports associated with Building 4171. Radiological surveys specific to Building 4171 have not been conducted. (HSA)	Pu-238, Pu-239, Pu-240, Pu-241,
4172	No		R	EU-07	Building 4172, X-Ray Building. Constructed in the early 1970s. Building 4172 was used as an X-ray room and for storage of sealed sources that were checked every six months to ensure no leakage occurred. Demolished in 2000. Use Authorization Series 68, originally dated January 30, 1975, first permitted XRadiography in this building.4 Operations where subsequently permitted under Use Authorization Series 93, edition C, June 30, 1978.2 Both of these authorizations permitted the use of sealed sources for radiography. On April 13, 1977, a radiographer was exposed to radiation from a non-shielded source inside the X-ray room. It is unlikely any environmental contamination resulted from this incident (A0057). • Building 4172 was mistakenly listed on an NRC license. The building was deleted from that license in December of 1982. No leaking sealed sources were ever detected during the biannual leak check program. It is likely that a routine survey was performed in Building 4172 prior to demolition; however, record of such survey could not be located in the Radiation Safety Records Management System. (HSA)	Am-241, Co-60, Eu-152, Eu-154,
4403	No	4011	R	EU-07	See 4011	See 4011
4500	No		R	EU-07	Building 4500, Gas Bottle Dock (Near Building 4011), Compressed Gas Bottle Storage Dock. Constructed in the middle1960s, Building 4500 was used as a storage area for portable gas containers, including argon,nitrogen, helium and various calibration gasses. By 1998, it was listed as “foundation only,” and left unused. The walls and foundation of Building 4500 are still in place. Building 4500 was used as a drop-off and pick-up point for suppliers. The high-pressure gas cylinders that were stored in Building 4500 were used through Area IV. There are no Use Authorizations and no Incident Reports associated with Building 4500. Radiological surveys specific to Building 4500 have not been conducted.(HSA)	Th-232
4521	No		R	EU-07	Site 4521 Parking Lot. Constructed prior to 1962, Site 4521 served as a parking lot for personnel working in Building 4011 and the surrounding areas. It was demolished in the middle 1960s. There are no Use Authorizations and no Incident Reports associated with Site 4521. Radiological surveys specific to Site 4521 have not been conducted. (HSA)	None
4611	No		R	EU-07	Building 4611, Paint Spray Canopy. Constructed prior to 1962, Building 4611 was a non-radiological facility. It is assumed that this building was an open structure used for spray painting. A more detailed history could not be located. On the 1962 Industrial Planning Map, Building 4611 is near 4011. Building 4611 is last labeled on the 1981 map, although it continues to be drawn on subsequent Industrial Planning Maps. Building 4611 has been demolished. There are no Use Authorizations and no Incident Reports associated with Building 4611. Radiological surveys specific to Building 4611 have not been conducted. (HSA)	None
4612	No		R	EU-07	Building 4612, Maintenance Storage. Constructed prior to 1962, Building 4612 appears on the 1962 Industrial Planning Map. On the 1964 Industrial Planning Map, a new structure, Building 4171, is shown directly adjacent to Building 4612. Building 4612 is last labeled on the 1982 map, although it continues to be drawn on subsequent Industrial Planning Maps. Building 4612 has been demolished, most likely in 2000, at the same time as Building 4171. There are no Use Authorizations and no Incident Reports associated with Building 4612. Radiological surveys specific to Building 4612 have not been conducted. (HSA)	None
4711	No	4011	R	EU-07	See 4011	See 4011
4413	Yes	4143	G	EU-08	See 4143	See 4143
4714	No		G, O	EU-08	Building 4714 Research and Development Shop Work Area was used as an outdoor work area associated with Building 4163. Radiological materials were not handled at this facility. There are no Use Authorizations and non Incident reports associated with Building 4714. Results of the independent verification survey indicated the Building 4714 location was below allowable limits. (HSA)	None
4010	Yes		L	EU-08	S8ER; also includes Site 4807 Electrical Equipment Pad, Site 4808 Electrical Equipment Pad, and Site 4809, Air Blast Heat Exchanger Pad; Building 4010 was used for experimental reactor tests. 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 dated June 27, 1961 referenced the April incident, but only indicated that the processing of samples from the April incident would be delayed. 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. 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. Surveys were conducted prior, during, and following demolition to determine contamination levels were below acceptable limits. A FUSRAP Survey Group from Argonne National Laboratory found in 1979 and reconfirmed in 1981 the area continued to meet unrestricted release criteria. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241,Co-60, Eu-152, Eu-154, H-3
4012	Yes		L	EU-08	SNAP Critical Test Facility, Heavy Metal Reflected Fast Spectrum Reactor, also operated as ETEC X-ray Facility and Storage. No incident Reports associated with Building 4012. Following D&D efforts, a comprehensive final radiological survey was completed. Results indicated that the facility was suitable for release without radiological restrictions. A 1996 verification survey by ORISE concluded that Building 4012 met DOE guidelines for unrestricted release. DHS performed confirmation survey in 1996. EPA conducted oversight verification survey in 2001 found the COCs for Building 4012 were mixed fission products, U, and activation products on the floors and walls. Acceptable limits for the survey were consistent with NRC regulatory guide. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241
4013	No		L	EU-08	Thermal Transient Test Facility; Non-Nuclear Component Assembly and Packaging Building; SNAP System Assembly and Checkout Building Includes Building 4713, Substation; Includes Building 4823, Time Clock; Includes Building 4413, Uninterruptible Power Supply (UPS). Building was used to assemble non-nuclear SNAP 10A and SNAP 2 ground test and flight test systems and was subsequently used for thermal transient testing. Also used to simulate seismic events for the purpose of stress testing. No incidents occurred in the Building 4013 that might have resulted in a release of contamination to the environment. A interior radiological survey showed results were below the acceptable limits. (HSA)	None
4019	Yes		L	EU-08	SNAP Flight System Critical Facility; Acceptance Test Facility; ETEC Construction Staging and Computer Facility. Building 4019 was built to perform criticality acceptance test of SNAP reactors before they were delivered for launch. Building was reassigned for non-nuclear use in the 1970s and 1980s. All radioactive and nuclear material handled at the facility was fully encapsulated. One incident was reported that could have resulted in a release to the environment. On April 10, 1976, a quality assurance inspection personnel was unable to return a source material to the safe directly after use. It was later discovered that the source had detached from its travel cable and the source was reattached and returned to the safe. Release of contamination to the environment as a result of this incident was unlikely. Surveys in 1988, 1996, 1998 concluded that the facilities met the criteria for release to unrestricted use. In 2001, EPA conducted an oversight verification survey and collected concrete core samples which were analyzed for photon-emitting isotopes. EPA field measurements confirmed the conclusions of the previous surveys. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241
4228	No		L	EU-08	Building 4228; Power Pak Facility; SCTI Co-Generation Plant; Includes Building 4708, Substation for Inbound Power ; Includes Site 4807, Electrical Equipment Pads; Includes Site 4808, Electrical Equipment Pads; Includes Site 4809, Air Blast Heat Exchanger Pad; Includes Building 4710, SCTI Power Pak Cooling Tower. The SCTI Power Pak facility was designed to harness the steam produced through SCTI’s sodium experiments and generate commercial electric power. There are no Use Authorizations and no Incident Reports associated with Building 4228. The SHEA Impact Review Checklist found the demolition of Building 4228 neither involved radioactive materials nor was conducted in a radiological area. This conclusion was confirmed by the release and demolition of Building 4012. (HSA)	None
4708	No	4228	L	EU-08	See 4228	See 4228

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4713	No	4012, 4013	L	EU-08	See 4013	See 4013
4719	No	4019	L	EU-08	See 4019	See 4019
4807	Yes	4010, 4228	L	EU-08	See 4010	See 4010
4808	Yes	4010, 4228	L	EU-08	See 4010	See 4010
4809	Yes	4010, 4228	L	EU-08	See 4010	See 4010
4XXX	No	4228	L	EU-08		
4710	No	4228	L, CC	EU-08	See 4228	See 4228
4823	No	4013	L,Q	EU-08	See 4013	See 4013
4059	Yes		M	EU-08	S8DR, Large Leak Test Rig; Ground Prototype Test Facility; Includes Building 4759, Substation. Facility accommodated a vacuum system that simulated outer space. 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 M-2 SSFL Area IV HSA (May 2005 Final) the cause of the leak in order to correct the cause and to improve reactor design. On February 12, 1970, an absolute filter on vacuum cleaner ruptured, contaminating the area. 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. 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. 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. 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. 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. 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. On December 22, 1998, it was found that contamination of fork truck and gloves was due to naturally occurring radon daughters. A 1978 radiological survey by Rockwell Intl concluded the facility met the release criteria for unrestricted use with the exception of the reactor chamber pit, pipe chase room and vacuum equipment room. Smear surveys conducted in the equipment rooms, support areas and the vacuum equipment room measured removable beta gamma contamination levels of <50 dpm/100cm2 (limit is 1,000 dpm/100cm2). Removable contamination from an earlier survey in the reactor chamber pit measured Group M SSFL Area IV HSA (May 2005 Final) M-3 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 x 10-6 µCi/ml. Groundwater samples showed less than 10-9 µCi/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. ORISE performed a radiological survey in 1995 to verify the Rockwell survey. 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. A survey by Boeing in 1999 concluded the Phase I of Building 4059 met the release criteria for unrestricted use. Additional surveys and sampling agreed with the conclusion. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, H-3
4459	No		M	EU-08	Building 4459 Uninterruptible Power Supply (UPS); Energy Technology Engineering Center (ETEC) Storage. Building 4459 contained a large diesel generator and flywheel, which, in combination, were designed to function as a fail-proof back-up power source. By 1992, Building 4459 was being used for non-radiological storage. There are no Use Authorizations and no Incident Reports associated with Building 4459. 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. (HSA)	
4759	No	4059	M	EU-08	See 4059	See 4059
4639	No		Not Built	EU-08		
4006	Yes		O	EU-08	Sodium Laboratory. Building 4006 was operated as a non-nuclear sodium laboratory. Building 4006 closed for operations in 1999. The septic tank was removed in 2000. The leach field was removed in 2001. Building 4006 is still standing but no longer in use. Use Authorization No. 66, dated September 28, 1973, specified that Na would be added to canisters containing UO2 in Building 4006. Use Authorization No. 81, dated June 26, 1974, permitted the use of tritiated titanium foils as gas chromatograph detectors. The foils were declared excess in 1986 and removed from the building. Use Authorization No. 101, originally dated April 8, 1976, permitted the handling of 0.5 µCi of Mn-54 contained in sections of activated piping with frozen sodium. This piping was packaged in aluminum piping; the unpacking occurred in Building 4006. Radiological surveys specific to the interior of Building 4006 have not been conducted. A radiation survey conducted on the contents of the septic tank returned removable alpha levels <20 dpm/cm2 and removable beta levels <100 dpm/cm2. Total alpha and beta levels were non-detect. Soil sampling performed during excavation of the leachfield, drain lines and septic tank did not detect any contamination. (HSA)	
4402	No		O	EU-08	MMHD Experiment. Building 4402 was a non-radiological facility; a more detailed record of associated activities could not be located. Building 4402 has been demolished. There are no Use Authorizations and no Incident Reports associated with Building 4402. Radiological surveys specific to Building 4402 have not been conducted. (HSA)	None
4506	No		O	EU-08	Constructed in the 1960s, Site 4506 serves as a parking lot used by personnel working in Building 4006, 4005, 4024, 4025 and the adjacent facilities. Site 4506 is still in use. There are no Use Authorizations and no Incident Reports associated with Site 4506. Radiological surveys specific to Site 4506 have not been conducted. (HSA)	None
4606	No		O	EU-08	SRE Support Complex. Building 4606 Sodium Lab Instrument Building A, MHD Support Building, Hydrogen Recombiner Test, Includes Building 4816, Hydrogen Recombiner Test Canopy. Constructed in the 1960s, Building 4606 was used to test the capacity of the Hydrogen Recombiner, a device developed by Atomics International (AI) to mix hydrogen and regular air to create water, useful in an emergency situation if a reactor produced excess hydrogen. Building 4606 has been demolished. There are no Use Authorizations and no Incident Reports associated with Building 4606. Radiological surveys specific to Building 4606 have not been conducted. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Th-232
4607	No		O	EU-08	Building 4607, Sodium Lab Instrument Building B, Storage. Constructed prior to 1962, Building 4607 was used for non-radiological storage and was demolished in the early 1970s. There are no Use Authorizations and no Incident Reports associated with Building 4607. Radiological surveys specific to Building 4607 have not been conducted. This area was covered as part of the 1994-1995 Area IV Radiological Characterization Survey. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. Survey results were below the acceptable limits. (HSA)	None
4615	No		O	EU-08	Building 4615 Combustion Test Facility. Constructed in the early 1980s, Building 4615 served as a non-radiological facility. A more detailed description of associated activities could not be located. Building 4615 has been demolished. There are no Use Authorizations and no Incident Reports associated with Building 4615. Radiological surveys specific to Building 4615 have not been conducted. (HSA)	None
4616	Yes	4006	O	EU-08	See 4006	See 4006
4704	No		O	EU-08	Building 4704 Main Electrical. Constructed prior to 1962, Building 4704 is an inbound transformer adjacent to a station owned by Edison Power and was scheduled for demolition in 2004. There are no Use Authorizations and no Incident Reports associated with Building 4704. Radiological surveys specific to Building 4704 have not been conducted. (HSA)	None
4706	No	4006	O	EU-08	See 4006	See 4006

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4816	No	4606	O	EU-08	See 4606	See 4606
4026	No		P	EU-08	Building 4026 Large Component Test Loop Control Building Small Component Test Loop Control Building Sodium Component Test Laboratory Includes Building 4726, Substation Includes Building 4805, Time Clock Shack Includes Building 4426, Uninterruptible Power Supply (UPS) Constructed in 1958, Building 4026 was used for testing components of sodium-cooled, graphite moderated reactors under simulated reactor operating conditions. Building 4026 consisted of a component area, a test tower and control building structures. Initially, there were three sodium tanks, two above grade, and a drain tank located below grade in a concrete, steel plate lined pit. Building 4026 was first described as a Large Component Test Loop (LCTL) Building. By 1972, it was referred to as a Small Component Test Loop (SCTL) Building. By 1987, Building 4026 was designated as a Sodium Component Test Laboratory. Demolished in 1999. On October 3, 1979, following routine pipe-weld radiographic exposure, an iridium-192 source could not be retracted into the storage shield. Employees received no significant radiation exposures as a result of this problem (A0238). No historical evidence indicates that unsealed regulated radioactive materials were handled at the facility. Prior to removal of the SCTL drain tanks, sodium in the system was tested for radiological contamination and none was detected. (HSA)	None
4226	No		P	EU-08	Building 4226 SCTL Motor Generator (MG) Building. Constructed in the early 1980s, Building 4226 housed non-radiological hazardous materials. Demolished in 1998. There are no Use Authorizations and no Incident Reports associated with Building 4226. At demolition and prior to offload, liquid sodium from the building was tested for radioactivity and found to be free of contamination. (HSA)	None
4293	No		P	EU-08	Building 4293 Construction Shack. Constructed in approximately 1971. Although designated as a construction facility, Building 4293 served as a time clock station. Demolished in approximately 1977. There are no Use Authorizations and no Incident Reports associated with Building 4293. Radiological surveys specific to Building 4293 have not been conducted. This area was covered as part of the 1994-1995 Area IV Radiological Characterization Survey. Background: 15.6 µR/hr. o Acceptable Limit: Less than 5 µR/hr above background. Survey results were below the acceptable limits. (HSA)	None
4334	No		P	EU-08	Building 4334 Kalina Control Room Constructed in the early 1990s, Building 4334 served as a control room for the Kalina facility. Demolished in 2003. There are no Use Authorizations and no Incident Reports associated with Building 4334. Radiological surveys specific to Building 4334 have not been conducted. (HSA)	None
4335	No		P	EU-08	Building 4335 Kalina Turbine Generator Room Constructed in the late 1980s or early 1990s, Building 4335 housed the turbine for the Kalina facility. Demolished in 2003. There are no Use Authorizations and no Incident Reports associated with Building 4335. Radiological surveys specific to Building 4335 have not been conducted. (HSA)	None
4354	No		P	EU-08	Building 4354 Control Element Test Structure Constructed in 1957, Building 4354 was a non-radiological facility used to test the mechanical systems by which control rods where moved in support of the Fast Breeder Reactor. Demolished in the middle 1980s. There are no Use Authorizations and no Incident Reports associated with Building 4354. Radiological surveys specific to Building 4354 have not been conducted. This area was covered as part of the 1994-1995 Area IV Radiological Characterization Survey. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. Survey results were below the acceptable limits. (HSA)	None
4355	No		P	EU-08	Building 4355 Sodium Component Test Installation Control Center Includes Building 4756, Substation Constructed in 1958, Building 4355 was used to monitor and control operations in Building 4356. Demolished in 2003. Use Authorization 117D, dated July 1, 1984, permitted the operation of Bowed Tubes Measurement. The authorization specified the use of a 1.0 µCi Co-60 sealed source that was checked annually to ensure no leakage occurred. During demolition in 2003, Building 4355 debris was surveyed daily for total and removable contamination. No radiological contamination was ever detected. (HSA)	None
4356	No		P	EU-08	Building 4356 Sodium Component Test Installation (SCTI) Includes Building 4656, Cooling Stacks Constructed in 1958, the primary purpose of Building 4356 was to generate steam from a sodium heat source. Demolished in 2002. Use Authorization Series 72, originally dated January 8, 1974, permitted the use of two 250 µCi Cs-137 sealed sources and one 100 µCi Cs-137 sealed source that were used as sodium level gauges. These sources were checked annually to ensure no leakage occurred. There has been one incident that could have resulted in a release to the environment associated with Building 4356. On October 9, 1974, during a semi-annual sealed source inspection and leak testing, a Cs-137 source was found to be missing. The source was found at an interior storage area where the source was leak tested. The source was confirmed to be intact and then stored appropriately (A0639). During demolition, Building 4356 debris was surveyed daily for total and removable contamination. No radiological contamination was ever detected. (HSA)	None
4357	No		P	EU-08	Building 4357 Heat Transfer Loop Control Building, Liquid Metal Engineering Center (LMEC) Pump Bearing Test Facility Control Building, Energy Technology Engineering Center (ETEC) Pump Bearing Test Facility Control Building, SCTI Supply Storage. Constructed in 1958, Building 4357 was first used as a Heat Transfer Loop Control Building and later a Pump Bearing Test Facility Control Building for LMEC and ETEC. By 1987, Building 4357 was a supply storage building for SCTI. The SCTI complex was a development test facility for liquid metal system components for the Department of Energy (DOE). The facility's mission was to provide a test site for the non-nuclear developmental testing of typical Liquid Metal Reactor (LMR) components, primarily steam generators. Demolished in 2002. There are no Use Authorizations and no Incident Reports associated with Building 4357. During demolition, Building 4357 debris was surveyed daily for total and removable contamination. No radiological contamination was ever detected. At demolition and prior to disposition, liquid sodium from the SCTI complex was tested for radioactivity and found to be free of contamination. (HSA)	None
4358	No		P	EU-08	Building 4358 Organics Reactor Development Building, Chemical Storage Building (SCTL, SCTI), Kalina Storage Building/Time Shack. Constructed in 1966, Building 4358 was initially used as a Chemical Storage Building and part of the SCTL support area. The function of the SCTL was to test components and instruments in a sodium environment. When SCTL was eliminated, Building 4358 became a storage building for SCTI and Kalina. The primary purpose of the SCTI was to test sodium-heated steam generators and sodium-to-sodium intermediate heat exchangers (IHX) under simulated sodiumcooled nuclear power plant operating conditions. Building 4358 was moved from its original location directly northwest of Building 4656 to a new location directly south of Building 4026 in approximately 1978. Demolished in 2003. There are no Use Authorizations or Incident Reports associated with Building 4358. During demolition, Building 4358 debris was surveyed daily for total and removable contamination. No radiological contamination was ever detected. At demolition and prior to disposition, liquid sodium from the SCTI complex was tested for radioactivity and found to be free of contamination. (HSA)	None
4359	No		P	EU-08	Building 4359 Compressor Building SCTI Compressor Building. Constructed in the 1970s, Building 4359 housed an air compressor for the SCTI facility. The SCTI complex was a development test facility for liquid metal system components for the DOE. The facility's mission was to provide a test site for the non-nuclear developmental testing of typical LMR components, primarily steam generators. Demolished in 2002. There are no Use Authorizations and no Incident Reports associated with Building 4359. During demolition, Building 4359 debris was surveyed daily for total and removable contamination. No radiological contamination was ever detected. At demolition and prior to offload, liquid sodium from the SCTI complex was tested for radioactivity and found to be free of contamination. (HSA)	None
4360	No		P	EU-08	Building 4360 Chemical Storage Building. Constructed in approximately 1987, Building 4360 was a chemical storage building part for SCTI, a development test facility for liquid metal system components for DOE designed to serve as a test site for the non-nuclear developmental testing of typical LMR components, primarily steam generators. Demolished in 1999. There are no Use Authorizations and no Incident Reports associated with Building 4360. Radiological surveys specific to Building 4360 have not been conducted. At demolition and prior to offload, liquid sodium from the SCTI complex was tested for radioactivity and found to be free of contamination. (HSA)	None
4361	No		P	EU-08	Building 4361 SCTI Hazardous Material Storage. Constructed in approximately 1992. Building 4361 first appears on Industrial Planning Maps in 1992, listed as the SCTI Hazardous Material Storage Building. Demolished in 2003. There are no Use Authorizations and no Incident Reports associated with Building 4361. During demolition, Building 4361 debris was surveyed daily for total and removable contamination. No radiological contamination was ever detected. At demolition and prior to offload, liquid sodium from the SCTI complex was tested for radioactivity and found to be free of contamination. (HSA)	None
4362	No		P	EU-08	Building 4362 Water Sampling Enclosure. Building 4362 was used to test the water that was used in the SCTI facility for purity. The SCTI complex was a development test facility for liquid metal system components for the DOE. The facility's mission was to provide a test site for the nonnuclear developmental testing of typical LMR components, primarily steam generators. Building 4362 was demolished in 2003. There are no Use Authorizations and no Incident Reports associated with Building 4362. During demolition, Building 4362 debris was surveyed daily for total and removable contamination. No radiological contamination was ever detected. At demolition and prior to offload, liquid sodium from the SCTI complex was tested for radioactivity and found to be free of contamination. (HSA)	None
4392	No		P	EU-08	Building 4392, SCTI Electrical Equipment. Constructed in approximately 1992, Building 4392 was an electrical equipment building for SCTI and Kalina. Building 4392 has been demolished. There are no Use Authorizations and no Incident Reports associated with Building 4392. Radiological surveys specific to Building 4392 have not been conducted. (HSA)	None
4426	No	4026	P	EU-08	See 4026	See 4026

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4457	No		P	EU-08	Building 4457 Pump Bearing Test Structure Foundation Only. Constructed in approximately 1972, Building 4457 was used for proof and performance testing of sodium lubricated bearings used in large sodium pumps. In July of 1972, a shaft seal failed, causing oil to contaminate the sodium system. Attempts to clean and repair the system failed. Building 4457 was subsequently gutted and used for storage of waste oils from non-radiological facilities. By 1996, Building 4457 was listed as "foundation only." The foundation was removed in 1999. Regulated radiological materials were not handled in Building 4457. No Use Authorizations or Incident Reports involving radiation were associated with this building. Radiological surveys specific to Building 4457 have not been conducted. (HSA)	None
4478	No		P	EU-08	Building 4478, CDHC Office Support Trailer, SCTI Control Building Support Trailer, Support Trailer (LMEC). Initially, Building 4478 was used as a support trailer. It contained offices and was located directly east of Building 4020. According to Industrial Planning Maps, between 1967 and 1971, the structure was moved from its original location to a position northwest of Building 4656. By 1971, the building was used to service SCTI. The SCTI complex was a development test facility for liquid metal system components for the DOE and its predecessors. The facility's mission was to provide a test site for the non-nuclear developmental testing of typical LMR components, primarily steam generators. Sodium was the liquid metal used at the facility. Construction of the SCTI was started in 1959. The facility began operating in 1964 and operated through 1996 by ETEC and its predecessors. By 1981 Building 4478 was used for radioactive count analysis. Building 4478 has been demolished. There are no Use Authorizations and no Incident Reports associated with Building 4478. At demolition and prior to offload, liquid sodium from the SCTI complex was tested for radioactivity and found to be free of contamination. Since radiological materials were not handled in Building 4478 and no contamination occurred, no further tests were conducted. (HSA)	None
4502	No		P	EU-08	Site 4502 Parking Lot Includes Building 4806, Time Clock Includes Building 4657, Guard Shack. Constructed prior to 1962, Site 4502 served as a parking lot for personnel working in Building 4006 and the surrounding areas. Site 4502 was demolished. There are no Use Authorizations and no Incident Reports associated with Building 4502. Radiological surveys specific to Site 4502 have not been conducted. (HSA)	None
4656	No	4356	P	EU-08	See 4356	See 4356
4657	No	4502	P	EU-08	See 4502	See 4502
4726	No	4026	P	EU-08	See 4026, 4826	See 4026, 4826
4756	No	4355	P	EU-08	See 4355	See 4355
4805	No	4026	P	EU-08	See 4026	See 4026
4826	No		P	EU-08	Building 4826 SCTL Test Facility Includes Building 4726, Substation. Constructed in 1958, Building 4826 was constructed to expand the testing capacities of Building 4026. Construction of the building consisted of adding a drain tank and enclosure to Building 4026. Building 4826 was designed to test components and instruments in a sodium environment. Demolished in 1998. There are no Use Authorizations and no Incident Reports associated with Building 4826. Results of a Building Reconnaissance Report conducted on July 1, 1996, found the building to be free of radiological contamination. At demolition and prior to offload, liquid sodium from the building was tested for radioactivity and found to be free of contamination. (HSA)	None
4310	No		P, L	EU-08	Building 4310 Portable Change Room. Constructed in the early 1960s, Building 4310 was used as a changing facility. Demolished in approximately 1973. There are no Use Authorizations and no Incident Reports associated with Building 4310. Radiological surveys specific to Building 4310 have not been conducted. This area was covered as part of the 1994-1995 Area IV Radiological Characterization Survey. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. Survey results were below the acceptable limits. (HSA)	None
4501	No		Q	EU-08	Site 4501 Parking Lot, Includes Building 4823, Time Clock. Constructed prior to 1962, Site 4501 was a parking lot at the corner of G Street and 17th Street. On the 1987 Industrial Planning Map the site is referred to as "Coil Storage." Site 4501 is now used as a storage yard. There are no Use Authorizations and no Incident Reports associated with Building 4501. Radiological surveys specific to Site 4501 have not been conducted. (HSA)	None
17th St. Drainage Area	Yes		Q	EU-08	17th Street Drainage. The 17th Street Drainage is a natural rainwater channel located south of the intersection of "G" Street and 17th Street. In 1962, a berm was constructed around the channel to provide a 30-foot by 30-foot hold-up pond. The pond cycled through periods of evaporative drying in summer and refilled during the rainy season; this caused the low-lying area to be marshy. Over time, the area became overgrown with shrubs and trees and filled with silt. In 1998, the entire drainage channel area was cleared of shrubs and trees. Characterization surveys performed in 1997 and 1998 identified elevated levels of Cs-137. As a result, remediation began during 1998, and a final status survey was performed. The principle contaminant of concern at the 17th Street Drainage Channel area was Cs-137. No other significant isotopes were found in the environment or soil without the adjoining presence of Cs-137. During the 1995 Area IV Radiological Survey, the pond area was inaccessible, so no samples were taken. Soil from the drainage channels to the north and south of the pond area was sampled and no contamination was found. In 1997, the pond area was accessible and several soil samples were taken. Two of the samples indicated Cs-137 at levels of 13.5 and 14.5 pCi/g. A radiation survey was then conducted in the areas to identify any locations above limits. In 1998, the original bermed pond area and all intakes and outlets were mapped and surveyed. Although exposure measurements did not exceed 3.4 µR/hr above the background level of 15 µR/hr at 1 meter, some elevated radiation measurements in localized areas at ground level were observed at a maximum of twice the background levels. All locations exceeding 5 µR/hr above background were identified. Soil samples in areas immediately north and immediately south of the berm indicated elevated levels of radionuclides. Cs-137 was found at 2 pCi/g, which was less than the cleanup standard of 9.2 pCi/g. Th-228 was found at 6 pCi/g, which was close to the cleanup standard limit. Uranium isotopes were found at 4 pCi/g, which was less than the cleanup standard of 30 pCi/g. All uranium samples resulted in ratios of uranium isotopes consistent with naturally occurring uranium. No processed or enriched uranium isotopes from fuel typically used at the Santa Susana Field Laboratory (SSFL) were found in this location. Although Th-228 was discovered at 6 pCi/g, its parent isotope Th-232 was found at background levels of 1 pCi/g. Since this specific thorium isotope was not processed or used at SSFL, the origin of elevated Th-228 is unknown. The majority of the soil samples did not exceed cleanup standards and did not pose a health risk; however, portions of the 17th Street Drainage area were excavated to attain levels as low as reasonably achievable (ALARA). On October 27, 1999, the Oak Ridge Institute of Science and Education (ORISE) Environmental Survey and Site Assessment Program (ESSAP) performed a verification survey of the 17th Street Drainage Area. Verification activities included document reviews, surface scans, exposure rate measurements and soil sampling. Cesium-137 ranged from non-detect to 1.6 pCi/g and exposure rate ranged from 15 to 19 µR/hr. DHS performed verification sampling in 1999. (HSA)	Cs-137
4735	No		R	EU-08	4735 Fuel Tank - 86,000-Gallon Fuel Oil Storage Day Tank. Constructed in 1977, Fuel Tank 4735 stored fuel that was pumped by the pump station to the Sodium Component Test Installation (SCTI) facility. Building 4320, the Fuel Oil Pump Building, filled the tank from the Fuel Tank Farm. Carbon steel piping connected the facilities. Bulk oil was removed in 1990 and Fuel Tank 4735 was cleaned in 1991. Demolished with the Fuel Tank Farm in 1999. There are no Use Authorizations and no Incident Reports associated with Fuel Tank 4735. Radiological surveys specific to Fuel Tank 4735 have not been conducted. Portions of this area was covered as part of the 1994-1995 Area IV Radiological Characterization Survey. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. Survey results were below the acceptable limits. (HSA)	None
4038	No		V	EU-08	Building 4038 is the Systems for Nuclear Auxiliary Power (SNAP) Office Building No. 2. It includes the ETEC Headquarters/ DOE Site Office, Liquid Metal Engineering Center (LMEC) Administration and Information, Energy Technology Engineering Center (ETEC) Administration, and is serviced by Substation 4757. Constructed in 1962, Building 4038 is 15,297 square feet and is constructed of a steel frame, roof and siding, anchored to a concrete floor. Beginning in December 2002 and continuing to the time of the HSA report, weekly entrance/exit radiation surveys are performed. No elevated radiation levels have been detected. (HSA)	
4039	Yes		V	EU-08	Building 4039 was the SNAP Administration Building. Constructed in 1964, Building 4039 was a single-story structure constructed of galvanized steel walls and roof that were anchored to a concrete slab floor. After Building 4039 became a counting laboratory in 2000, radiological surveys were performed weekly from April 14, 2000 through April 11, 2001. All wipe measurements were less than the minimum detectable activity (MDA). Alpha MDA ranged from 8-12 dpm/100cm2, beta MDA ranged from 15-20 dpm/100cm2. Prior to demolition in April 2003, the building was again surveyed using wipe samples, beta detectors and gamma exposure instruments. All wipe samples were less than the MDA, and all instrument readings were non-detect. (HSA)	
4057	No		V	EU-08	Building 4057 has housed Launch Handling & Mobile Equipment Development, LMEC Laboratory, Static Sodium Test Facility, ETEC General Test, and is serviced by Substation 4757. Constructed in 1961, Building 4057 was constructed of a steel frame, siding and roof anchored to a concrete slab. Building 4057 housed two sodium test rigs. Building 4057 was decommissioned for laboratory use in 1998 at which point it became a records room and was in use at the time of the HSA. In 2003, air sample media (filter papers) was discovered in a folder of records. Some of these filters had low levels of residual contamination; however, surveys of the drawer contents provided that none of the contamination had escaped from the envelope containing the filters. The majority of contaminated samples measured less than the Nuclear Regulatory Commission (NRC) Regulatory Guide 1.86 release limit of 1,000 dpm/100 cm2 for removable contamination. Based on survey results, the incident was deemed to be	

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
					an insignificant hazard. (HSA)	
4626	No		V	EU-08	Building 4626 has been the Equipment Storage Building, LMEC Inventory Storage, ETEC Inventory Storage, and the SNAP Storage Building. Constructed in 1963, Building 4626 has a roof height ranging from 15 to 25 feet with a steel frame, siding and roof anchored to a concrete slab. It was equipped with a 2-ton bridge. There are no Use Authorizations and no Incident Reports associated with Building 4626. Building 4626 was not used to store nuclear fuel or radioactive materials. A storage yard west of Building 4626 has been used to store barrels of activated sand from Building 4059 containing Eu and Co-60. A radiological survey of the storage yard was conducted and survey results were below the acceptable limits. (HSA)	
4757	No	4038, 4057	V	EU-08	See 4038 and 4057.	
4020	Yes		AA	EU-09	Hot Laboratory - Building 4020 housed the Rockwell International Hot Laboratory, Component Development Hot Cell (CDHC), and includes Building 4323, Guard Building and Building 4720, Substation. It was constructed in 1959 for the remote handling of radioactive materials. The Hot Lab was used for the disassembly and examination of irradiated nuclear fuel assemblies from various nuclear reactors, the disassembly and examination of Systems for Nuclear Auxiliary Power (SNAP) Reactor core, analysis of irradiated test materials, manufacture and leak testing of sealed radioactive sources, and machining of radioactive Co-60. (HSA) Building 4020 was used for decladding of irradiated Pu bearing fuels from off-site reactors from 1976 to 1986. Following, DOE began D&D of the facility. Between 1987 and 1991 decontamination efforts focused on the removal of general contamination from support areas, decontamination rooms and hot cells. Decontamination to support demolition occurred from 1992 to 1995, and the structure was demolished and backfilled in 1996. (HSA) A number of incidents occurred during operation of the facility which may have resulted in a release to the environment. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154, Pm-147 (Final D&D Report) Prior to D&D: Alpha and beta contamination Primarily old mixed fission products (137Cs, 90Sr, 147Pm) 60Co small amounts of uranium (< 0.01%) trace amounts of plutonium (Final Status Survey) Cs-137, gamma emitting radionuclides, Sr-90, Am-241 isotopic Plutonium, isotopic Thorium, isotopic Uranium
4323	No	4020	AA	EU-09	See 4020	See 4020
4468	Yes		AA	EU-09	Holdup Tank constructed in 1959 to support the operations of Building 4020 by receiving and storing radioactive effluent generated by the operation of the Hot Lab. The 3,000-gallon liquid waste tank was removed in 1994 after the drainage system was removed from the Hot Lab building. DOE approved the removal of RMMA for the Hot Lab facility in November of 1998, which included the holdup tank and leach pits. Demolished in 1997, with the surrounding soil excavated an additional 4 feet. (HSA)	
4520	No		AA	EU-09	Parking lot constructed 1959, served as the parking lot for the Hot Lab facility. Was demolished in 1996 as part of the Hot Lab D&D effort. (HSA)	See 4020
4720	No	4020	AA	EU-09	See 4020	See 4020
4806	No	4502	P, U	EU-09	See 4502	See 4502
4383	No		S	EU-09	Building 4383, Instrumentation Building, Liquid Metal Engineering Center (LMEC) Assembly and Test Building, LMEC Construction Staging, Includes Building 4393, Tower at 4383 Includes Building 4883, Substation. Building 4383 first appears as the Instrumentation Building on the 1962 map. On the following map, in 1967, it is listed as the LMEC Assembly and Test Building. On the following 1971 map it is listed as the LMEC Construction Building and remains such until its final appearance on the 1975 map. It was demolished in the early 1980s. There are no Use Authorizations and no Incident Reports associated with Building 4383. Radiological surveys specific to Building 4383 have not been conducted. This area was covered as part of the 1994-1995 Area IV Radiological Characterization Survey. Background: 15.6 µR/hr. Acceptable Limit: Less than 5 µR/hr above background. Survey results were below the acceptable limits. (HSA)	None
4393	No	4383	S	EU-09	See 4383	See 4383
4482	No		S	EU-09	Building 4482 Government Project Office. Constructed in 1968, Building 4482 served as an office building. Transferred off-site in 2000. Building 4482 was donated to the Wildlife Way Station, and later reclaimed. The trailer was then surveyed by both Boeing and the Los Angeles County Health Department and recommended for release for unrestricted use. There are no Use Authorizations and no Incident Reports associated with Building 4482. Boeing and the Los Angeles County Health Department conducted radiation surveys. Both surveys determined that the trailer was free of radiological contamination. (HSA)	None
4484	No		S	EU-09	Building 4484 Rest Room Trailer. Building 4484 was constructed in 1969. Building 4484 was used as office space. Transferred off-site in 2000. Building 4484 was donated to the Wildlife Way Station and later reclaimed. The trailer was then surveyed by both Boeing and the Los Angeles County Health Department and recommended for release for unrestricted use. There are no Use Authorizations and no Incident Reports associated with Building 4484. Boeing and the Los Angeles County Health Department conducted radiation surveys. Both surveys determined that the trailer was free of radiological contamination. (HSA)	None
4485	No		S	EU-09	Building 4485, LMEC Office Trailer. Constructed in 1968, Building 4485 was used as office space. Transferred off-site in 2000. Building 4485 was donated to the Wildlife Way Station and later reclaimed the trailer. The trailer was then surveyed by both Boeing and the Los Angeles County Health Department and recommended for release for unrestricted use. There are no Use Authorizations and no Incident Reports associated with Building 4485. Boeing and the Los Angeles County Health Department conducted radiation surveys. Both surveys determined that the trailer was free of radiological contamination.	None
4486	No		S	EU-09	Building 4486, LMEC Office Trailer. Building 4486 was constructed in 1968. Building 4486 was used as office space. Transferred off-site in 2000. Building 4486 was donated to Shandon High School and later reclaimed. The trailer was then surveyed by both Boeing and the Los Angeles County Health Department and recommended for release for unrestricted use. There are no Use Authorizations and no Incident Reports associated with Building 4486. Boeing and the Los Angeles County Health Department conducted radiation surveys. Both surveys determined that the trailer was free of radiological contamination. (HSA)	None
4487	No		S	EU-09	Building 4487, Energy Technology Engineering Center (ETEC) Engineering Building, Safety Health and Environmental Affairs (SHEA) Office. Constructed in 1981, Building 4487 was used for office space and was demolished in 2004. There are no Use Authorizations and no Incident Reports associated with Building 4487. Periodic surveys were conducted from December 2002 until Building 4487 was demolished. Entrance/exit surveys did not detect any radiological contamination. Radiological surveys and samples taken during excavation of the Building 4487 septic tank did not detect any radiological contamination. (HSA)	None
4538	No		S	EU-09	Site 4538 Parking lot for Buildings 4482-4486. Site 4538 was a parking lot used by personnel working in Buildings 4482-4486, all of which were office buildings. Demolished in 2000. There are no Use Authorizations and no Incident Reports associated with Site 4538. Radiological surveys specific to Site 4538 have not been conducted. (HSA)	None
4883	No	4383	S	EU-09	See 4383	See 4383
4461	No		T	EU-09	Building 4461 Sodium Pump Test Facility (SPTF) Motor Generator Building. Constructed in 1977, Building 4461 housed the electrical equipment that powered the motors in SPTF. Building 4461 is still standing. There are no Use Authorizations and no Incident Reports associated with Building 4461. Radiological surveys specific to Building 4461 have not been conducted. (HSA)	None

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4462	No		T	EU-09	Building 4462 SPTF Building Includes Building 4760, Substation. Constructed in 1974, Building 4462 was used to test sodium pumps. Scheduled for demolition in 2005-2006. There are no Use Authorizations associated with Building 4462. No incidents occurred in Building 4462 that might have resulted in a release to the environment. Radiological surveys specific to Building 4462 have not been conducted. (HSA)	None
4463	No		T	EU-09	Building 4463, Sodium Cleaning and Handling Facility Includes 4780, Substation. Constructed in 1974, Building 4463 was used to assemble, disassemble and clean pumps and other parts of the SPTF. Building 4463 is still standing. There are no Use Authorizations and no Incident Reports associated with Building 4463. Radiological surveys specific to Building 4463 have not been conducted. (HSA)	None
4662	No		T	EU-09	Site 4662 Small Parts Cleaning Pad. Constructed in approximately 1981, Site has been used for cleaning sodium off of parts in support of SPTF. Site 4662 is still in use. There are no Use Authorizations and no Incident Reports associated with Site 4662. Radiological surveys specific to Site 4662 have not been conducted. (HSA)	None
4760	No	4462	T	EU-09	See 4462	See 4462
4780	No	4463	T	EU-09	See 4463	See 4463
4062	No		U	EU-09	Constructed in 1963, Building 4062 operated as a non-nuclear support building for the ETEC program, serving as a storage facility for instrument calibration and was serviced by Substation 4762. Building 4062 was demolished in 1999. No radiological surveys specific to Building 4062 were conducted. (HSA)	
4065	Yes		U	EU-09	Constructed in 1963, Building 4065 initially operated as a vacuum test facility. After 1973, it served as a non-nuclear chemical laboratory that performed sodium research and was equipped with a scanning electron microscope. It was serviced by Substation 4762 and was demolished in 1999. Use Authorization Series 39 (tests for the SNAP program), 61 (fuel friction tests), 74 (analytical x-ray generator), 75 (gas chromatography detectors), and 164A (gas chromatograph probe) were issued from 1971 to 1996. Radiological surveys specific to Building 4065 were not conducted. Building 4065 did not require radiological controls during demolition. (HSA)	
4066	No		U	EU-09	Constructed in 1963, Building 4066 was used for calibrating and testing non-radiological equipment and was demolished in 1999. Building 4066 was serviced by Substation 4762 and Time Clock 4806. An incident occurred in October 1966, during which an in-line vacuum switch was removed from the tiltpour pumping system and hand carried by Atomics International (AI) personnel to the building. When the instrumentation technician opened the switch to calibrate it, a fine black powder (presumably U3O8) sifted out and onto his clothing and workbench. The area surrounding the workbench was subsequently decontaminated (A0599). Radiological surveys specific to Building 4066 were not conducted. (HSA)	
4762	No	4062, 4065, 4066	U	EU-09	See 4062, 4065, and 4066.	
4015	No		W	EU-09	Building 4015 was Construction Staging Storage and includes Building 4707, Substation. It was constructed in 1974 in the same place as Parking Lot 4573, was used to store construction materials, and demolished in 2004. (HSA)	
4343	No	4573	W	EU-09	See 4573	
4373	Yes		W	EU-09	SNAP Critical Test Facility - Building 4373 was the Systems for Nuclear Auxiliary Power (SNAP) Critical Facility and includes Site 4848, Pad at Building 4373. Constructed in 1956, it was designed as a solid propellant mixing and casting facility; however, there is no evidence that it was ever used for this purpose. One test cell was modified for critical assembly research supporting the SNAP program by adding two feet of additional concrete shielding to two walls and installing a high-efficiency particulate air (HEPA) filter bank. In 1962 the SNAP critical tests concluded, and the facility was modified again to include a NaK test loop to support the SNAP Experimental Reactor. The other test loop programs carried out here 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. It was demolished in 1999. (HSA) Most nuclear or radioactive materials handled at Building 4373 were fully encapsulated. Only fissile material and activation foils produced low levels of radioactivity. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241; (Final Status Survey) Ambient gamma exposure rates Removable alpha/beta
4374	No		W	EU-09	Building 4374 was constructed in 1956 to test non-nuclear liquid metal heat transfer loops and was used as a support facility for Building 4373. It was located within the Building 4373 boundary fenceline. Building 4374 was abandoned with an old mercury test loop in place and demolished in 1996. (HSA)	(Final Status Survey) Ambient gamma exposure rates Removable alpha/beta
4573	No		W	EU-09	Site 4573 was a Parking Lot and includes Building 4343, Time Clock. The parking lot was constructed in 1956 and served as a parking lot for personnel working in Buildings 4373 and 4055. It was removed in 1974 and Building 4015 was constructed on the former location of Site 4573. (HSA)	
4707	No	4015	W	EU-09	See 4015	
4848	Yes	4373	W	EU-09	See 4373	
4055	Yes		X	EU-09	NMDF - Building 4055 is the Nuclear Materials Development Facility (NMDF) and includes Building 4755, Substation and Building 4155, Control Center, Guard Shack. It was constructed in 1967 and from 1968-69, 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 7 months in 1970, the NMDF fabricated mixed uranium-plutonium oxide pellets for irradiation tests. The NMDF was then in standby until March 1974 when it was activated to participate in the Advanced Fuel Systems Program for liquid metal fast breeder reactors and to demonstrate reduced TRU solid waste with the use of a molten salt combustor. D&D efforts began in late 1979 and the entire building was stripped to the walls and decontaminated, equipment was disposed of as low-level waste, and the liquid waste and exhaust systems were removed. The facility is currently used for non-radiological research. (HSA)	U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241; (HSA), plutonium uranium, U and Pu decay and daughter products, primarily Am-241
4155	Yes	4055	X	EU-09	See 4055	See 4055
4755	Yes	4055	X	EU-09	See 4055	See 4055
4483	No		S	EU-09 & EU-07	Building 4483, LMEC Office Trailers. Building 4483 was constructed in 1968 and was used for office space. Transferred off-site in 2000. Building 4483 was donated to the Wildlife Way Station and later reclaimed. The trailer was then surveyed by both Boeing and the Los Angeles County Health Department and recommended for release for unrestricted use. There are no Use Authorizations and no Incident Reports associated with Building 4483. Boeing and the Los Angeles County Health Department conducted radiation surveys. Both surveys determined that the trailer was free of radiological contamination. (HSA)	None
4100	Yes		BB	EU-10	Building 4100 houses the Advanced Epithermal Thorium Reactor (AETR), Fast Critical Experiment Laboratory (FCEL), and Radiation Safety and Computed Tomography and includes 4100, Trench and Building 4800/4710, Substation. It was constructed in 1960 and 20 reactor core configurations were studied here. Early reactors in the AETR were thorium or uranium fueled; later tests of reactors with highenergy (fast) neutrons were conducted at the FCEL. The program was terminated in 1974 and NRC terminated License CX-17 (for Building 4100) and released the building for unrestricted use in October 1980. (HSA) After D&D the high bay was used for sodium fire suppression experiments. The high bay is currently used as a high energy Computer Aided Tomography (CAT) facility. The labs are used by Radiation Safety for a radioactive sample counting lab and instrument calibration facility. (HSA) The trench next to the building which was used to burn construction debris and is regulated under RCRA for soil contamination, but it is unlikely that any regulated radiological materials were disposed of there. (HSA)	Alpha Beta-gamma
4510	No		BB	EU-10	Site 4510 served as a parking lot for personnel working in Building 4100 and the surrounding areas and is now an open field. (HSA)	
4800	No	4100	BB	EU-10	See 4100	See 4100

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4100 Trench	No	4100	BB	EU-10	AETR Test Facility (1960-1974), Radiation Instrument Calibration and Radiological Sample Counting Laboratory (1985-present) See 4100	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Th-232, Co-60, Eu-152, Eu-154, H-3; See 4100
4009	Yes		CC	EU-10	OMR Critical Facility, SGR Critical Facility. Building 4009 was constructed in 1958 and housed the Organic Moderated Reactor (OMR), Sodium Graphite Reactor (SGR), and includes Buildings 4709, Substation. The OMR was a low-power critical experiment facility for testing reactor geometries and fuel elements in a reactor moderated and cooled by organic liquids. The SGR was a low-power critical experiment facility for testing fuel and sodium configurations in a reactor cooled by sodium and moderated by graphite. There were two incidents at the facility that may have resulted in releases to the environment. In 1967, all equipment associated with the OMR and SGR was removed. (HSA) In the 1980s and early 1990s the facility was used for storage and testing of Rocketdyne's In-Service Inspection (ISI) equipment. In the late 1980s, the west high bay was used for high-energy rate forging (HERF) that included handling of high-enriched uranium. Eight hundred pounds of depleted uranium was stored in the facility and shipped off site in the early 1990s. (HSA)	Sr-90, Cs-137, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Co-60, Eu-152, Eu-154; (Final Status Survey), U-238, Th-232, U-235, K-40, Cs-137, Cs-134 Co-60
4509	No		CC	EU-10	Site 4509 served as a parking lot for personnel working in Building 4009 and the surrounding area. (HSA)	
4709	No	4009	CC	EU-10	See 4009	See 4009
4056 Landfill	No		V	EU-10	The 4056 Landfill is a 160,000-square-foot fenced area directly north of Building 4100. Constructed prior to 1962, the landfill served as a disposal area for construction and excavation materials from Building 4056 (never constructed). Soil that was removed from the proposed site of Building 4056 was placed in the landfill. The 4056 Landfill was later used as a disposal area for non-radiological facilities. There are no Use Authorizations and no Incident Reports associated with the 4056 Landfill. In 1988, Rockwell International conducted a radiological survey with results that were below the acceptable levels. During the 1996 Area IV Radiological Characterization Survey, soil samples were taken at two different locations in the vicinity of Building 4056. None of the measurements were distinguishable from background. In 2003, a Global Positioning System (GPS) radiation scanning cart was used to map radiation levels at the site. No elevated radiation was observed. And no contamination was detected in subsequent soil sampling and trenching. (HSA)	
4425	No		DD	EU-11	Solar Concentrator Facility was constructed in the middle 1980s and used in experiments aimed at harnessing solar power. This building was a 25 kWt parabolic dish-Sterling engine generator, which consisted of a mirrored parabolic dish concentrator, 10.7 m in diameter, and a solar receiver. (HSA)	
4885	No		EE	EU-11	Pistol Range constructed prior to 1962 and demolished in the early 1980s. Building 4885 consisted of four or five covered shooting stations on a concrete pad and a downfield berm. (HSA)	
4886	Yes		EE	EU-11	Sodium Disposal Facility was constructed in the early to middle 1950s. From 1956 to 1978, the facility was used to clean non-radioactive metallic sodium and NaK from various scrap test components before they were disposed. It was also used to treat non-radioactive waste sodium and NaK and to burn nonradioactive combustible liquid waste, such as oils. Building 4886 consisted of a large, rectangular pit filled with water. The site has been remediated and re-vegetated. (HSA) The facility was not designed to use or store radioactive materials; however, during the course of normal treatment and disposal operations, radioactive materials were inadvertently introduced into the facility, which resulted in contamination of the soil. (HSA)	(Final Status Survey) Gamma Radiation Survey Detected Gamma Spectroscopy: K-40, Sr-90, Cs-137, Th-232, Ac-228, Th-228, Pb-212, U-238, Th-234, U-234, Th-230, Pb-214, Bi-214, U-235
4173	No		Y	EU-12	This area was a sodium storage pad in 1962. By 1967, it was being used as Gammagraph X-ray site. This pad housed a sealed gamma-emitting source used for X-ray purposes. It has been demolished. The gamma-emitting source (which was checked annually to ensure no leakage occurred) was used and stored on a concrete pad. There is no evidence that a permanent building ever existed in this location. On April 25, 1978, 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 replaced and two employees received two mrem of exposure in the process. (HSA)	
4363	Yes		Y	EU-12	Mechanical Component Development and Counting Building - Transferred from the Rocketdyne Division to the Atomics International (AI) Division in 1956-1957 to support expansion of the AI activities at SSFL. The Mechanical Component Development and Counting Building and was used for sodium systems in support of the Sodium Reactor Experiment (SRE) from before 1959 until 1963. Building 4363 likely had a radioactivity counting room which may have been moved from the Engineering Test Building Annex in 1957. Building 4363 has been used primarily for storage since 1963. A decontamination effort was conducted in 1995. Building 4363 was demolished in 2001; the sanitary leachfield system was removed in 2002. (HSA)	(Final Status Survey) uranium mixed fission and activation products, Cs-137 low enrichment uranium (2.75%), Sr-90, Alpha, beta, and gamma activity
4375	Yes		Y	EU-12	The building was constructed in 1959 as a test shelter for outside control-rod test towers (Sites 4874 and 4875). This building was used to support the SNAP program, but was not involved in nuclear work. After the building was abandoned, barrels that may have contained radioactive material were stored in the surrounding area. The building was demolished in 1999. (HSA)	(HSA) Ambient gamma exposure rates
4473	No		Y	EU-12	The Hydraulic Test Facility was used to conduct preliminary tests on piping, pumps and other loop components. Water was used, because it has a similar flow rate to liquid sodium. The tests where designed so the researchers could examine descriptors such as fatigue rates and results such as fracturing of components. The Hydraulic Test Instrumentation Building was the control center for the Hydraulic Test Loop (Building 4863). The building was demolished in 2003. (HSA)	
4575	Yes		Y	EU-12	Site 4575 was a parking lot located west of Building 4375. Building 4375 was used as a non-nuclear control center for testing SNAP control rod assemblies. Building 4375 was used to support the SNAP program, but was not involved in nuclear work. After the building was abandoned, barrels that may have contained radioactive material were stored in the surrounding area, which may have included Parking Lot 4575. Site 4575 has been removed. (HSA)	(HSA) Ambient gamma exposure rates
4863	No		Y	EU-12	The Hydraulic Test Facility was constructed in approximately 1961 used as a preliminary test for piping, pumps and other loop components. This facility combined pressure, temperature and different water in its testing. Water was used because it has a similar flow rate to liquid sodium. The tests where designed such that the researchers could examine descriptors such as fatigue rates and results such as fracturing. The Hydraulic Test Loop was the experimental loop portion of the facility. The building was demolished in 2003. (HSA)	
4873	No		Y	EU-12	Building 4873 first appears and is labeled the Fuel Rod Test Tower and Pad on the 1967 map. There is no record of any activity with fuel rods at this location. Building 4873 is most likely a pad located directly north of Building 4363 and is addressed in that building remediation and release. The Hydraulic Test Facility was used as a preliminary test for piping, pumps and other loop components. This facility combined pressure, temperature and different types of water in its testing. Water was used because it has a similar flow rate to liquid sodium. The tests where designed so that researchers could examine descriptors such as fatigue rates and results such as fracturing. The Hydraulic Test Laboratory was where the engineers established the parameters of the experiment. Building 4873 was demolished in 2003. (HSA)	
4874	Yes		Y	EU-12	Site 4874 was constructed in the late 1950s and used to support the SNAP program, but was not involved in nuclear work. After the building was demolished in the early 1970s, barrels that may have contained radioactive material were stored in the surrounding area. (HSA)	(HSA) Ambient gamma exposure rates
4875	Yes		Y	EU-12	Site 4875 was used to support the SNAP program, but was not involved in nuclear work. However, due to the proximity of Building 4374 (a nuclear facility), radioactive and/or nuclear materials may have been handled there. In addition, after the building was abandoned, barrels that may have contained radioactive material were stored in the surrounding area. It was constructed in the late 1950s and demolished in the middle 1970s. (HSA)	(HSA) Ambient gamma exposure rates
4353	Yes		Z	EU-12	Building 4353 housed the Organics Reactor Development Building, Research and Development (R&D) Laboratory Building, General Storage, and includes Site 4853, Concrete Pad. It was constructed in 1956 as an R&D Laboratory for the Organic Moderate Reactor Program, and the primary usage has been general storage. The steel portion of the structure was removed in the late 1970s, the concrete pad was removed in 2001 during septic tank removal. (HSA)	

Appendix B – Historical Site Assessment Summary

Site	Impacted	Included in	Group	Exposure Unit	Historical Use Impacting COCs	Identified Contaminants
4553	No		Z	EU-12	Site 4553 served as a parking lot for personnel working in Building 4353 and the surrounding areas. It was constructed prior to 1962 and is no longer in use. (HSA)	
4853	Yes	4353	Z	EU-12	See 4353	
4854	No		Z	EU-12	Building 4854 was constructed sometime between 1964 and 1967 and was used to test Radiation Fuel Gauges. It was demolished in the late 1990s. (HSA)	
4314	No	4814	DD	EU-13	See 4814	
4317	No		DD	EU-13	Building 4317 was part of a pistol range was a roofed area with open sides that was used to stand under while shooting firearms. There was an earthen berm down range to capture discharged bullets. Building 4317 has been demolished. (HSA)	
4514	No	4814	DD	EU-13	See 4814	
4730	No		DD	EU-13	The Impact Test Control Building was constructed in the late 1960s and appears on Industrial Planning Maps from 1967-1972. It housed the controls for the Isotope Impact System Test Device in Building 4820. Demolished in the mid 1970s. (HSA)	
4814	No		DD	EU-13	The Large Leak Injector Device (LLID), Sodium Water Reaction Test Structure includes Building 4314, LLID Test Control Building and Building 4514, Sodium-Water Reaction Test Center. Building 4814 was used in 1975 in tests that analyzed steam and water density at the point at which a pipe ruptured. Building 4314 housed a control room for Building 4814 and Building 4514; the Sodium-Water Reaction Test Center was also associated with the buildings, which were demolished in the late 1970s. Use Authorization 83, issue date November 7, 1974, permitted the use of a 25 Ci Cs-137 sealed source, which was checked annually to ensure no leakage occurred, in a DD Electronics Gamma Densitometer. Following each test using the gamma densitometer, radiological surveys were conducted to confirm that contamination had not occurred. (HSA)	
4820	Yes		DD	EU-13	The Isotope System Impact Test Device was constructed in the late 1960s and demolished in the mid 1970s. It was used for impact testing of normal ZrH Fuel. (HSA) Use Authorization 5, issued on February 25, 1970, permitted possession of 1 kg of fuel that contains 10% (by weight) of normal U for impact testing of F28 normal ZrH Fuel. This process involved firing a small mass (58.33g) of fuel into a granite target. This was repeated 12 times at varying velocities. The experiment was conducted in an enclosed casing with three openings, two for camera lenses and one for the projectile. Upon impact, each projectile was pulverized. (HSA)	
4318	No		DD	EU-13	Building 4318 was part of a pistol range was a roofed area with open sides that was used to stand under while shooting firearms. There was an earthen berm down range to capture discharged bullets. Building 4318 has been demolished. (HSA)	
4701	No		FF	EU-14	Water tank constructed prior to 1967, used to store water for the site. Water flowed out from the tank only, It is unclear how it was refilled. (HSA)	
4702	No		FF	EU-14	Water tank constructed prior to 1967, used to store water for the site. Water flowed out from the tank only, It is unclear how it was refilled. (HSA)	
4865	No	4173	Y	EU-15	See 4173	
4001	No		Not Built			
4052	No		Not Built			
4638	No		Not Built			
4640	No		Not Built			
4810	No		Not Built			

Appendix C

Radionuclide Background Sources

Appendix C
Radionuclide Background Sources

C.1 Naturally Occurring Radionuclides

Natural radionuclides in the environment are of two general classes, primordial and cosmogenic. The identification sources and global ranges of these is discussed below. While above-ground nuclear testing represents a man-made, not natural, source of radionuclides, associated radionuclides are present in the environment in the absence of on-site operations. Contribution to "naturally-occuring radionuclide" background from nuclear testing is also discussed below.

C.1.1 Primordial Radionuclides

Primordial radionuclides are mostly isotopes of heavy elements belonging to three decay series headed by ^{238}U (uranium series), ^{235}U (actinium series), and ^{232}Th (thorium series). The head (or parent) radionuclides of these series have half-lives on the same order as the age of the Earth (10^9 years) and are consequently assumed to represent the primordial inventory. The members of these decay series exist in a state of activity equilibrium on a global basis dictated by the rate of decay of the head of the series. However, local concentrations can vary widely due to separations occurring in nature due to different leaching rates from rocks. An example of this is the leaching of ^{226}Ra from rocks at a faster rate than the ^{238}U parent due to alpha radiation recoil energy of the parent decay breaking the lattice structure of the rock. Radium-226 then has a sufficiently long half-life to exist in soils and waters at higher concentrations than its ^{238}U parent. The ratio of ^{226}Ra to ^{238}U varies at different locations due to the different chemical composition of the rocks and the soil in the area. In addition, a parent's concentrations can vary from one location to another depending on the type of geological formation present. Therefore, it is prudent to determine background concentrations of parent and associated long-lived decay products (or progeny) on a relatively local basis, where "long-lived" is typically defined as a half-life of six months or longer. Short-lived decay products (with half-lives less than six months) are often expressed using "+D" with the longest long-lived parent. (For example, ^{238}U+D includes: ^{238}U, ^{234}Th, ^{234m}Pa, ^{234}Pa all assumed to be present at the same concentration.) Naturally-occurring decay series, including long-lived and short-lived (+D) progeny plus associated half-life, are summaries in Table C-1

As a default, background concentrations of long-live progeny and associated +D products can be assumed in equilibrium with the series parents. However, series concentrations below radon may not be in equilibrium with the parents since radon is a gas and my escape from the soil by emanation. Since radon and progeny may also be in the background air environment of the laboratory detectors, analytical results based on their measurement are normally disregarded and they are assumed to be in equilibrium with the associated radium parent for risk calculation purposes. Therefore, natural background level establishment is not necessary for them.

Table C-1. Natural Radioactive Decay Series including Progeny and Associated Radiation

Uranium Series			Thorium Series			Actinium Series		
Long-lived [c] Radionuclides	**Short-lived Progeny [b]**	**Half-life [c]**	**Long-lived [c] Radionuclides**	**Short-lived Progeny [b]**	**Half-life [c]**	**Long-lived [c] Radionuclides**	**Short-lived Progeny [b]**	**Half-life [c]**
^{238}U (start)		4.47×10^{9} yrs	^{232}Th (start)		1.4×10^{10} yrs	^{235}U (start)		7.04×10^{8} yrs
	^{234}Th	24.1 days	^{228}Ra		5.75 yrs		^{231}Th	25.5 hrs
	^{234m}Pa	1.17 min		^{228}Ac	6.13 hrs	^{231}Pa		32,760 yrs
	^{234}Pa	6.7 hrs	^{228}Th		1.91 yrs	^{227}Ac		21.77 yrs
^{234}U		244,500 yrs		^{224}Ra	3.66 days		^{227}Th	18.72 days
^{230}Th		77,000 yrs		^{220}Rn	55.6 sec		^{223}Fr	21.8 min
^{226}Ra		1,600 yrs		^{216}Po	0.15 sec		^{223}Ra	11.43 days
	^{222}Rn	3.82 days		^{212}Pb	10.64 hrs		^{219}Rn	3.96 sec
	^{218}Po	3.05 min		^{212}Bi	60.55 min		^{215}Po	0.00178 sec
	^{214}Pb	26.8 min		^{212}Po	3.07×10^{-7} sec		^{211}Pb	36.1 min
	^{218}At	2.0 sec		^{208}Tl	3.07 min		^{215}At	0.0001 sec
	^{214}Bi	19.9 min	^{208}Pb		(stable)		^{211}Bi	2.14 min
	^{214}Po	1.64×10^{-4} sec					^{211}Po	0.516 sec
	^{210}Tl	1.3 min					^{207}Tl	4.77 min
^{210}Pb		22.3 yrs				^{207}Pb		(stable)
	^{210}Bi	5.01 days						
	^{210}Po	138 days						
	^{206}Tl	4.20 min						
^{206}Pb		(stable)						

a) Long-lived is defined as exhibiting a radiological half-life of 6 months or greater.
b) Short-lived is defined as exhibiting a radiological half-life less than 6 months.
c) Source = *The Health Physics and Radiological Health Handbook* edited by Bernard Shleien, Scinta Inc, Silver Springs, MD, 1992.

Since ^{235}U is naturally uniformly present at 0.7 % by mass of ^{238}U concentrations, activity concentrations for ^{235}U and its decay chain can also be calculated from the ^{238}U activity concentration based on the ratio of their specific activities. For 1 pCi/g of ^{238}U, there will be ~0.047 pCi/g of ^{235}U and its decay chain to radium will also be in equilibrium.

There are two other (non-series) primordial radionuclides that decay directly to stable nuclides. These are ^{40}K and ^{87}Rb. Potassium-40 is so widespread that it contributes about one-third of both the external terrestrial and internal whole-body dose from natural background radiation.[1] Rubidium-87 is only a beta emitter and is important only as an internal radiation source.

Many of the naturally occurring isotopes of uranium, thorium, and protactinium undergo spontaneous fission as an alternative to the principal mode of radioactive decay, and small amount of ^{239}Pu are naturally produced by activation. Therefore, some fission and activation products are produced naturally in the earth. However, the concentrations of these are most often much smaller than and indistinguishable from quantities resulting from fallout from nuclear weapons testing and releases from nuclear reactor accidents, which will be discussed later. Reference background levels for primordial radionuclides are shown in Table BB.

C.1.2 Cosmogenic Radionuclides

Cosmogenic radionuclides are produced by interactions of cosmic nucleons with target atoms in the atmosphere or in the earth. These radionuclides have mostly intermediate or low atomic numbers and are beta- and gamma-ray or x-ray emitters. There are many different radionuclides produced by a variety of spallation and neutron activation reactions. However, there are only four that are produced in large enough quantities or with long enough half-lives to be of dosimetric or risk concern: ^{14}C, ^{3}H, ^{22}Na, and ^{7}Be. Concentrations of these vary by latitude and by time depending on season and amount of sun spot activity. Nuclear weapons testing also increased the concentrations of these radionuclides. The quantities of ^{3}H produced by thermonuclear tests completely overshadow naturally produced ^{3}H and will be discussed later. The concentrations of the other three radionuclides in the atmosphere only increased by about a factor of 2 for ^{14}C to a factor of 50 for ^{22}Na at their highest concentrations. However, the concentrations of these radionuclides in the atmosphere have decreased since 1962 due to decay and exchange with the ocean.[2] Less than 1% of the world inventory of ^{14}C is in land surfaces and the biosphere while the numbers for ^{3}H, ^{22}Na, and ^{7}Be are approximately 35%, 44%, and 20% respectively.[3]
Reference background levels for cosmogenic radionuclides are shown in Table BB.

C.2 Global Fallout from Nuclear Weapons Tests

Between 1945 and 1980, approximately 450 nuclear weapons were detonated in the atmosphere, mostly in the Northern Hemisphere. The later high yield thermonuclear weapons tests deposited fallout on a global scale. Since 1980, most nuclear weapons tests have been

[1] "Exposure of the Population in the United States and Canada from Natural Background Radiation," NCRP Report No. 94, December 1987, pp. 5.
[2] Ibid., p. 36
[3] Ibid., pp. 38-39

performed underground with smaller yields that have not contributed significantly to global fallout. Since about 1975, the deposition rate of fallout has been less than the decay rate of the material already on the ground for most fallout radioisotopes of concern.[4]

There are three types or sources of radioisotopes produced from nuclear explosions. The majority of radioactivity produced from nuclear explosions is from fission products. These are primarily beta/gamma emitters in the mid atomic weight range with half-lives from seconds to over a hundred years. A second source is activation products produced by neutron activation of the elements of the device itself or of its surroundings. These include isotopes of iron, manganese, cobalt, zinc, carbon (^{14}C), and hydrogen (^{3}H or tritium), in addition to transuranic isotopes such as plutonium produced by activation of the ^{238}U in the device. The third source is unfissioned uranium, plutonium, or tritium material originally present in the device itself.[5]

It would not be possible to list specific quantities for all of the radionuclides possibly produced by atmospheric nuclear tests. However, based on fission or activation yields and on half-lives, only certain radioisotopes are of primary interest from a background determination standpoint. These include ^{90}Sr, ^{137}Cs, and plutonium isotopes as well as the ^{241}Pu progeny, ^{241}Am and to a lesser extent ^{99}Tc, ^{129}I, ^{3}H, and ^{14}C.

A relatively uniform pattern of plutonium distribution from fallout characterizes soil deposition. The highest accumulations are located in the northern hemisphere in the latitudinal band of 50 to 40 degrees. Fallout deposition levels in the southern hemisphere are approximately an order of magnitude less. Cesium-137, on the other hand, while deposited fairly uniformly, migrates in the environment with the soil to which it is bound tightly. Both cultivated soil and reservoir sediments serve as a sink or a trap for cesium being washed out of watershed soils. Therefore, soil concentrations vary significantly depending on the degree of erosion or sedimentation. Reference background levels for fallout radionuclides are a shown in Table C-2.

Table C-2. Radionuclide Background Reference Data

Nuclide	mCi/km^2	mCi/km^2	pCi/cm^2	pCi/g	Reference
	(Calculated from Fallout Estimates)				
U.S. Soil					
Cs-137	60	26.1	2.6	0.17	Eisenbud (1987) pp. 331; Richie, J.C., and McHenry, H.R. (1978) pp. 40-44
Sr-90	80	32.8	3.3	0.22	Eisenbud (1987) pp. 335.
Pu-239	1.4	1.4	0.14	0.0092	Eisenbud (1987) pp. 335.
Pu-239	--	2.2	0.22	0.0144	Bennett (1978); Hardy et al. (1973) pp.444-445
Am-241	--	0.8	0.08	0.0052	Bennett (1978)
U.S. Sediment					
Cs-137	--	--	--	1	Eisenbud (1987) pp. 119.
Cs-137	676	397	39.7335	2.61	Richie, J.C., and McHenry, H.R. (1978) pp. 40-44

[4] Ibid., p. 153
[5] Ibid., p. 154

Table C-2. Radionuclide Background Reference Data

Continental Soils					
K-40	--	--	--	10.8	NCRP Report No. 94 (1987)
Rb-87	--	--	--	1.4	NCRP Report No. 94 (1987)
Th-232	--	--	--	1.0	NCRP Report No. 94 (1987)
U-238	--	--	--	1.8	NCRP Report No. 94 (1987)

Bennett, B.G. 1978. *Environmental Aspects of Americium*, Department of Energy, Environmental Measurements Laboratory, EML-348, (1978).

Eisenbud, Merril 1987. *Environmental Radioactivity*, Academic Press, pp. 331.

Hardy, E.P., Krey, P.W., and Volchok, H.L. 1973. "Global Inventory and Distribution of Fallout Plutonium," *Nature*, 241. pp.444-445.

NCRP (National Council on Radiation Protection and Measurements) 1987. *Exposure of the Population in the United States and Canada from Natural Background Radiation*, Report No. 94.

Richie, J.C., and McHenry, H.R. 1978. "Fallout Cesium-137 in Cultivated and Noncultivated North Central United States Watersheds," J. *Envrion. Qual.*, 7,1 pp. 40-44.

Appendix D

Statistical Evaluation of Radiological Background Distribution

Appendix D
Statistical Evaluation of Radiological Background Distribution

Concentrations of primordial radionuclides are dependent on the geological formation the soil is found in. In addition, concentrations of cosmogenic and fallout radionuclides may have been affected by the climate and topography of the area since they affect runoff, sedimentation and movement through soil. Therefore, it is desirable to develop background concentrations from unaffected locations that are in the same geologic formation and similar in climate and topography. Therefore, a background data set will be developed from available from the unaffected areas surrounding the site in the same geological zones. The above mentioned screening levels are estimated using a series of data filters as described

The first screening step is to eliminate from consideration any sample within the SSFL Area IV boundary and buffer zones. The vast majority of the Area IV and buffer areas likely contain SRC concentrations consistent with background (un-impacted) media. However, there is a higher potential for encountering residual contamination within the Area IV boundary, and the null hypothesis for the site (per MARSSIM guidance) is that concentrations are present above health-based concentration limits; thus only offsite data are considered in estimating background concentrations.

Area IV of the SSFL is dominated by the Chatsworth (Kcs) geologic formation, comprising approximately 220 acres of the 290-acre Area IV footprint. The remaining approximately 70 acres, located in the southwestern corner of Area IV, is primarily comprised of the Santa Susana (Tsu) formation. Therefore, the second screening step is to eliminate offsite samples collected from other than soils within the Kcs and Tsu footprints.

Area IV contains multiple natural and man-made drainages that could impact offsite soil/sediment concentrations. The third screening step is, therefore, to eliminate from consideration any sample collected from an Area IV drainage area. Samples collected in the vicinity of these surface water bodies but not within the drainage itself (such as campsites) are retained for consideration pending the result of other filters. Note that samples collected just outside of the Area IV and buffer boundaries and are not associated with drainage are retained by this filter.

Some non-detected results appear to have been altered by assigning 1.0 or 0.5 times the reported minimum detectable activity (MDA). EPA through Risk Assessment Guidance for Superfund (RAGS) suggests assigning the LLD (assumed to mean MDL) for radionuclides when the actual result is not provided (the MDL is approximately equal to one-half the MDA). Using the MDA would be non-conservative for producing background screening levels (i.e., overestimates actual concentrations). By assigning the MDA the average concentration in the example could actually be greater than the maximum measured value. As a consequence the calculated background screening value could result in determining an area is non-impacted when it actually is (Type I error). For this reason one half of the reported MDA was assigned

when the reported value is equal to the MDA (exceptions to this rule are noted later for ^{3}H, ^{90}Sr, ^{238}Pu, and ^{239}Pu).

The final step was screening samples based on obvious outlier conditions. In a few cases offsite sample results appear to represent substantially different concentrations when compared to the balance of the dataset (e.g., twice the next highest result). Outliers are identified using probability plots and professional judgment. A probability plot of normally distributed results (generally expected in background) would produce a relatively straight line sometimes with a curved tail on both ends. A dramatic deviation from linearity indicates non-normality and suggests the presence of contamination (or at least multiple populations). It is noted, however, that some deviation from linearity can be present even in background due to a number of random variable – professional judgment is used in these cases.

Figure 3-3 of the main text presents the sample locations included in background screening value estimates. The Kcs and Tsu footprints are presented for reference as are SSFL boundaries. Note that due to the scale some locations appear on or very close to surface water bodies. These locations were investigated and actually fall off the drainages, such as on campsites near the feature in question. Also due to the scale, it is difficult to resolve closely clustered samples – sometimes 5 to 10 or more samples appear as a single location on the figure. The intension of the map is to show general locations relative to Area IV and geologic formations and not to provide location-specific details associated with individual samples or sample clusters – other project documents available on-line may serve that function.

Radiological Constituents – Uncertainties

Eighty-seven $^{239/240}Pu$ samples (assuming all measure concentrations are attributable to ^{239}Pu) were considered from the offsite dataset, but 70 of these results were assigned concentrations relative to the MDA. Because of this bias on the majority of samples, the background values were calculated using only the 17 un-altered samples. Similarly, 130 ^{238}Pu samples were considered from the offsite dataset but 81 of these results were assigned concentrations relative to the MDA. Because of this bias on the majority of samples, the background values were calculated using only the 49 un-altered samples. Thirty-nine of the 59 ^{3}H results were assigned relative to the MDA. Because of this bias on the majority of samples, the background values were calculated using only the 28 un-altered samples. Finally, for ^{90}Sr, many samples were assigned 0.5 times the MDA with high MDA values relative to the detected results. To eliminate the bias, only non-detected ^{90}Sr results with MDLs less than or equal to the average detected value (~ 0.046 pCi/g for Kcs) were used.

Half-lives of ^{137}Cs and ^{90}Sr are about 30 years each, which is non-trivial considering the age of some offsite analytical data. That is, if a sample was collected 10 years ago the present concentration with a 30-year half life is about 80 percent of the original measured value. This would be a concern if comparing data reported from different timeframes. However, the onsite data and offsite data were collected within the same timeframe (i.e., both sets containing relatively new and relatively old data), thus it is appropriate to directly compare all data regardless of collection date. The assumption is that the average date for offsite data is about the same as that for onsite data, introducing uncertainty in the analysis.

Most offsite tritium results for soil are reported with the unit pCi/L (assumed to represent the soil moisture fraction). Because the actual moisture fractions (along with other information allowing accurate conversion to pCi/g units) are not available, only results reported with pCi/g units were considered. It is also noted that the half-life of ^{3}H is 12.6 years, thus the age of the data can be relevant if comparing data from samples collected over relatively large spans of time. However, the age of the offsite and onsite data are similar, so as with ^{137}Cs and ^{90}Sr above, ^{3}H results are used without decay corrections.

Figure D-1 presents a series of probability plots for naturally-occurring SRCs and **Figure D-2** presents plots for man-made SRCs. As many as three data series are presented: sample results associated with Kcs, sample results associated with Tsu, and sample results identified as outliers. Potential outliers are identified for five radionuclides (represented as red squares in the figures)samples containing ^{137}Cs greater than 0.9 pCi/g, ^{3}H greater than 0.5 pCi/g, ^{238}Pu greater than 0.06 pCi/g, ^{226}Ra greater than 3 pCi/g, and ^{238}U greater 2 pCi/g were screened from further consideration. One ^{228}Th result above 2 pCi/g and a small cluster of ^{230}Th results centered at about 1.5 pCi/g were evaluated as potential outliers, but these values were judged not unexpected for background conditions thus were retained in the background dataset. The single ^{239}Pu result of 0.06 pCi/g also appears to be an outlier. However, this is the only Kcs samples and not unexpected for a background dataset. Table 3-2 also shows that the combined (Kcs plus Tsu) UTL95 value is the same as the Tsu value, i.e., this single results does not alter overall results.

Figures D-1 and D-2 illustrate distinct differences in the Kcs and Tsu populations, with Tsu values more tightly clustered and, depending on the SRC, often skewed to one side of the combined dataset, especially for ^{226}Ra. This suggests background concentrations have statistically different characteristics when comparing Kcs and Tsu formations. However, the respective samples were often collected by different organizations, during different time periods, and using different analytical laboratories. Also, the overall number of samples available for the Tsu formation is relatively small. As a result, one can not conclusively say populations are different considering all available information. Formation-specific populations generally do, however, overlap and the UTL95 calculations in Table 3-2 show similar average and UTL95 results, with two noted exception (^{226}Ra and the aforementioned ^{239}Pu). Radium-226 results in the Tsu are clearly skewed to the low side of the combined dataset producing a ULT95 of 0.72 pCi/g compared to the Kcs value of 2.6 pCi/g. The combined UTL of 2.4 pCi/g underestimates background in the Kcs and overestimates it in the Tsu. Because the number of samples available for the Tsu formation is small and because Area IV is dominated by the Kcs formation, the combined ^{226}Ra UTL95 is deemed appropriate for use across the entire SSFL Area IV.

Finally, some of the plots show deviations from linear at the low of end of the distribution. This is due at least in part to the practice of assigning concentrations relative to the MDA instead of reporting the actual measured value. Without a significant and costly effort the actual values will not be known, though it is assumed the modified results overestimate actual concentrations.

In conclusion, presented results are generally consistent with expected conditions including normal-like distributions, relative concentrations consistent with naturally occurring decay

series, and appropriateness of scale. The combined dataset produces generally conservative screening values for soils within the dominant onsite formation (Ksc) and is still reasonable if applied to the Tsu. A combined dataset also simplifies the data screening and data gap analysis process, thus the combined Kcs/Tsu values presented in Table 3-2 are deemed appropriate for use in SSFL background screening and average background subtraction, if used.

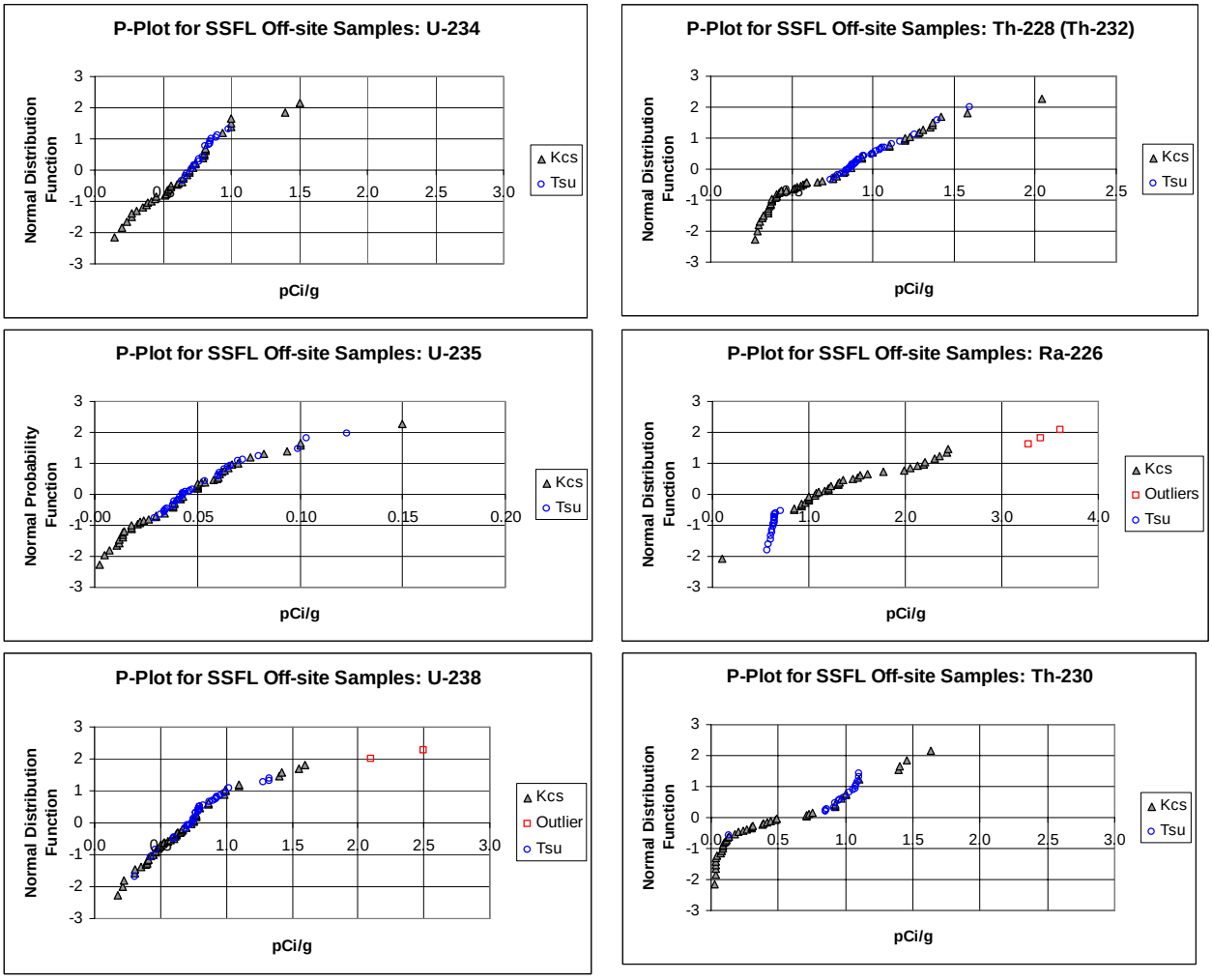


Figure D-1. Probability Plots for Naturally-Occurring Constituents in Background

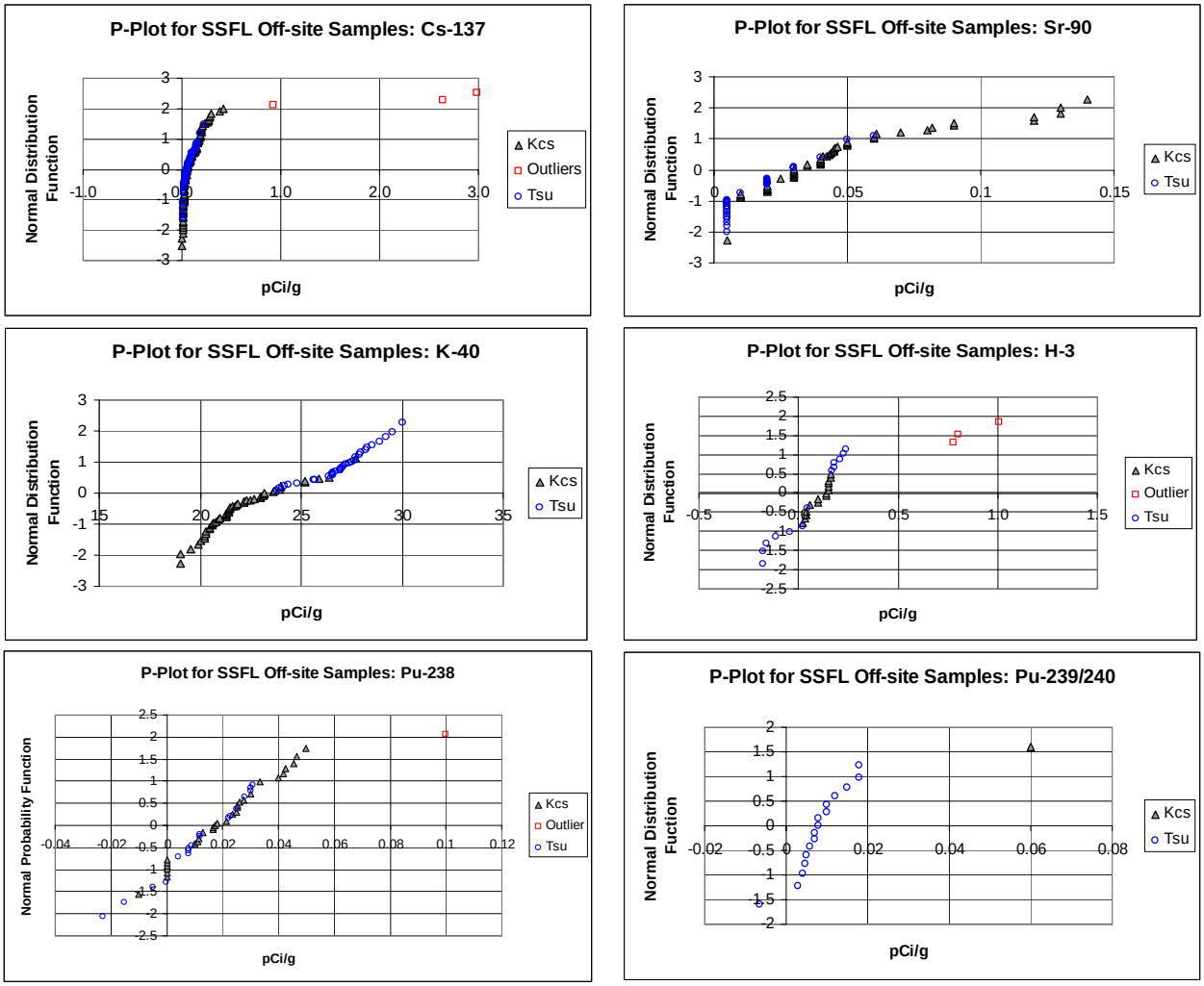


Figure D-2. Probability Plots for Potential Man-made Constituents in Background

Appendix E

Supporting Information for Ecological Risk: Parameters Required to Calculate Biota Concentration Guides and Data Usability Screening Tables for Radionuclides

Appendix E
Supporting Information for Ecological Risk: Parameters Required to Calculate Biota Concentration Guides and Data Usability Screening Tables for Radionuclides

This appendix contains three tables supporting the calculation of biota concentration guides (BCGs) for select radionuclides in accordance with *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE 2002). BCGs are used in this report as preliminary remediation goals (PRGs) for radionuclides in media to which ecological receptors could be potentially exposed (Section 3.3.3.1). BCGs are thus analogous to ecological screening levels for chemicals (Section 3.3.3.2). For this report, BCGs are calculated for RPECs for which DOE (2002) does not report a BCG.

Table E-1 shows the derivation of dose coefficients that determine the internal dose to ecological receptors per unit radionuclide in the receptor's tissue. Table E-2 shows the derivation of dose coefficients that determine the external radiological dose to ecological receptors per unit radionuclide in three environmental media: soil, water and sediment. Table E-3 shows the derivation for two media (soil and water) of the "lumped parameter" used to calculate the radionuclide concentration in terrestrial animal tissue per unit radionuclide in the environmental medium and lists the biouptake factors used to calculate the radionuclide concentration in aquatic animal tissue per unit radionuclide in water. Internal and external dose coefficients, lumped parameters and biouptake factors are required to calculate BCGs.

This appendix also includes four tables summarizing (by exposure unit [EU]) the activity (concentration) data for radionuclides in samples from three soil horizons and shallow groundwater. These tables are used to evaluate the quality and usability of historical data for assessing risk to ecological receptors in the SSFL Area IV EIS. The data summaries in these four tables include, for each analyte in each EU, the number of samples and detects; the minimum, maximum, and mean detected concentrations and standard deviation; and the minimum and maximum reported detection limits. Tables E-4, E-5, and E-6 summarize the data for radionuclides in the 0 – 2 foot below ground surface (ft bgs), 2 – 4 ft bgs and 4 – 6 ft bgs soil horizons, respectively. These tables include the derived soil background concentration values (Table 3-2) and the ecological PRGs for radionuclides in soil (Table 3-4). Table E-7 summarizes the data for radionuclides in shallow groundwater and includes the ecological PRGs for radionuclides in water for terrestrial animals (PRG WT, Table 3-4) and aquatic animals (PRG WA, Table 3-5). All four tables include the number of samples for each analyte in each EU that exceed the PRG and ratios of the maximum detected result and the PRG.

Table E-1. Parameters Required to Calculate Internal Dose Coefficients for Calculated Biota Con

Radionuclide	Eα	Qα	Eβ	Eγ	Y	$DC_{internal,I}$ (rad/d per pCi/g)
Fe-55	--	20	0.004	0.002	1	3.073E-07
Mn-54	--	20	0.004	0.836	1	4.302E-05
Na-22	--	20	0.194	2.193	1	1.223E-04
Ni-59	--	20	0.005	0.002	1	3.585E-07
Ni-63	--	20	0.017	--	1	8.707E-07
Pu-240	5.156	20	0.011	0.002	1	5.282E-03
Pu-241	<	20	0.005	<	1	2.565E-07
Progeny U-237	--	20	0.196	0.143	2.45E-05	--
Ba-133	--	20	0.054	0.402	1	2.336E-05

Data from Table A.1, Eckerman and Ryman (1993)

Dose coefficient (DC)

$DC_{internal}$ includes daughters with half-lives less than 100 years, per pages M3-17 and M3-18 in DOE (2002).

$DC_{internal,i}$ (rad/d per pCi/g) = 1dis s^{-1} /Bq ($\Sigma_i\Sigma_j Y_j E_j Q_j$) x (1.6022E-06 erg MeV^{-1}) x (8.64E04 s d^{-1}) x 0.01 g rad/erg x 0.037 Bq/pCi

where:

$DC_{internal,i}$ = rad/d per pCi/g of wet tissue of radionuclide i

Y_j = yield (abundance) of radiation j per disintegration of nuclide i;

E_j = energy (MeV) of radiation j for nuclide i; and

Q_j is the radiation weighting factor (quality factor, also called WR) for radiation j of nuclide i.

Q = 20 for alpha in the general screening phase; Qβ and Qγ are 1

Table E-2. Parameters Required to Calculate External Dose Coefficients for Calculated Biota Concentration Guides

Radionuclide	Ee	Ep	Ep+e	$DC_{ext, soil,i}$	$DC_{ext,water}$	$DC_{ext, sediment,i}$	source
Fe-55	0.004	0.002	0.006	3.07E-07	1.54E-10	1.54E-07	calculated using energies
Mn-54	0.004	0.836	0.84	4.30E-05	2.15E-08	2.15E-05	calculated using energies
Na-22	0.194	2.193	2.387	1.22E-04	6.11E-08	6.11E-05	calculated using energies
Ni-59	--	--	--	3.40E-07	1.70E-10	1.70E-07	DOE 2002, Module 3, tables 2.1-2.3
Ni-63	--	--	--	8.80E-07	4.40E-10	4.40E-07	DOE 2002, Module 3, tables 2.1-2.3
Pu-240	--	--	--	5.00E-07	2.50E-10	2.50E-07	DOE 2002, Module 3, tables 2.1-2.3
Pu-241	--	--	--	2.70E-07	1.30E-10	1.30E-07	DOE 2002, Module 3, tables 2.1-2.3
Ba-133	0.054	0.402	0.456	2.33E-05	1.17E-08	1.17E-05	calculated using energies

Energies (E) from Eckerman and Ryman (1993), Table A.1

Calculated using the equations below (pp. M3-7 and M3-8 in DOE 2002):

Dose coefficient (DC)

$DC_{ext,soil}$ (rad/d per pCi/g) = (5.12E-05) *$E_{photons+electrons}$ (MeV/disintegration)

$DC_{ext,water}$ (rad/d per pCi/L) = (2.56E-08) *$E_{photons+electrons}$ (MeV/disintegration)

$DC_{ext,sediment}$ (rad/d per pCi/g) = (2.56E-05) *$E_{photons+electrons}$ (MeV/disintegration)

Table E-3. Parameters Required to Calculate Lumped Parameters for Calculated Biota Concentration Guides

Radionuclide	f_1	**Biv** (kg dry soil/ kg wet plant)	Biv reference	PT/IT	k_{rad}	$LP(soil)_{i,terrestrial\ animal}$	$LP(water)_{i,terrestrial\ animal}$	Biv,aa,i	Biv,aa, reference
Fe-55	1.00E-01	8.89E-04	Baes et al 1984, converted to wet weight	3.01E+02	7.03E-04	4.88E+00	3.244645092	4066	EPA 1999, aquatic invertebrate, mean of 14 inorganics
Mn-54	1.00E-01	5.56E-02	Baes et al 1984, converted to wet weight	3.01E+02	2.22E-03	3.84E+00	2.509992495	4066	EPA 1999, aquatic invertebrate, mean of 14 inorganics
Na-22	1.00E+00	1.67E-02	Baes et al 1984, converted to wet weight	3.01E+02	7.30E-04	4.88E+01	32.29381783	2300	BDAC website, value for Na-24, crayfish
Ni-59	5.00E-02	7.11E-03	EPA (1999), App Table C-2, converted to wet wei	9.10E-01	2.53E-08	9.41E-02	1.844138552	78	EPA 1999, fish
Ni-63	5.00E-02	7.11E-03	EPA (1999), App Table C-2, converted to wet wei	9.10E-01	1.98E-05	9.38E-02	1.837368476	78	EPA 1999, fish
Pu-240	1.00E-03	1.00E-02	DOE 2002, value for Pu-239	5.70E+03	2.91E-07	1.02E+00	0.036880949	1000	DOE 2002, table 4.1, value for Pu-239
Pu-241	1.00E-03	1.00E-02	DOE 2002, value for Pu-239	5.70E+03	1.32E-04	9.98E-01	0.035991545	1000	DOE 2002, table 4.1, value for Pu-239
Ba-133	1.00E-01	3.33E-02	Baes et al 1984, converted to wet weight	3.01E+02	1.77E-04	5.42E+00	3.569436023	633	EPA 1999, fish

Values for f_1 are from Eckerman et al (1988)
Biv = water to plant bioaccumulation factor; for terrestrial plant, soil BCG it is used in place of Lumped Parameter (LP)
Biv dry/wet conversion = 4.5, per Table 4.2 (pg M3-49) of DOE (2002)
PT/IT from Zach (1985); values not found in Zach are averages of all PT/IT values found in Zach (1985); mean = 300.8
Biv,aa = aquatic animal accumulation factor, used in place of LP for aquatic animal water BCG
Biv values reported by EPA as the average of 14 inorganics with data available: antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc (see value/note for aluminum).
When more than one Biv,aa was available (fish, crustacean, invertebrate, etc), the largest value was used for conservative reasons.
Equations from DOE (2002), pg M3-40:

$$LP(soil)_{i,terrestrial\ animal} = \frac{\text{Canimal soil}}{\text{Csoil}} \quad \frac{= f1[(Biv + f)(10\text{-}3\ a/dc\ 70M0.75) + PT/IT\ X\ 0.481M0.76](1\text{-}e^{-}(krad + kbio)(365.25)*1.02M0.3)}{(krad+kbio)M}$$

$$LP(water)_{i,terrestrial\ animal} = \frac{\text{Canimal water}}{\text{Cwater}} \quad \frac{= f1\ 0.099M0.90(1\text{-}e^{-}(krad + kbio)(365.25)*1.02M0.3)}{(krad+kbio)M}$$

Mean parameters used per DOE 2002, Table 3.1 (pg M3-41):
a, ratio of active to maintenance metabolic rate (see equation 13) = 2
d, fraction of energy ingested that is assimilated (see equation 13) = 0.65
c, caloric value of food intake (see equation 13) = 5
f, fraction of diet that is soil (see equation 15) = 0.1
M, body mass in kilograms = 1 kg
X Dust loading (equation 16) = 0.001
kbio assumed unimportant (not included in calculations).
krad = ln(2)/t1/2, where t1/2 is radioactive half-life in days (standard decay equation, see wikipedia, http://en.wikipedia.org/wiki/Half-life).
Radioactive half-lives from Eckerman and Ryman (1993), Table A.1. Half-lives given in years multiplied by 365 to get $t_{1/2}$ in days.

Radionuclide	$t_{1/2}$ (d)	k_{rad}
Fe-55	985.5	7.033E-04
Mn-54	312.5	2.218E-03
Na-22	949.73	7.298E-04
Ni-59	27375000	2.532E-08
Ni-63	35040	1.978E-05
Pu-240	2386005	2.905E-07
Pu-241	5256	1.319E-04
Ba-133	3920.1	1.768E-04

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
Exposure Unit 1															
10028-17-8	Tritium (H-3)	pCi/g	200000	8	1	0.067	0.067	0.0246875	0.00088388		0.025	0.025		3.35E-07	0.35
10045-97-3	Cs-137	pCi/g	20	76	39	0.06	2.702	0.314167895	0.55752574		0.0025	0.03		1.35E-01	0.24
10098-97-2	Sr-90	pCi/g	20	26	3	0.32	0.45	0.09125	0.0576899		0.015	0.1775		2.25E-02	0.1
10198-40-0	Co-60	pCi/g	700	20	1	0.063	0.063	0.0254875	0.00452368		0.01675	0.035		9.00E-05	0
13966-00-2	K-40	pCi/g	119	28	28	17	25.5	20.74285714	2.15791885					2.14E-01	30
13966-29-5	U-234	pCi/g	5000	30	30	0.5	1.4	0.832333333	0.19143169					2.80E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3	20	1	0.05	0.05	0.0199125	0.0026978		0.01425	0.0275		4.42E-03	0
13981-16-3	Pu-238	pCi/g	5270	28	2	0.004	0.007	0.007294643	0.00346347		0.00075	0.01175		1.33E-06	0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	8	8	0.45	1.1	0.8425	0.18820581					2.20E-02	2.5
14119-32-5	Pu-241	pCi/g	190000	20	2	1.2	1.2	0.61125	0.15862796		0.45	0.825		6.32E-06	0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	8	8	0.42	1.8	0.8325	0.48150805					1.80E-04	1.6
14274-82-9	Th-228	pCi/g	530	8	8	0.51	1.5	0.9	0.36866555					2.83E-03	1.6
14331-83-0	Ac-228	pCi/g		20	20	0.85	1.53	1.224	0.15802731	20					1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520	22	1	0.12	0.12	0.035988636	0.00399887		0.029	0.0425		7.89E-05	0
15117-48-3	Pu-239	pCi/g	6000	28	3	0.004	0.021	0.005392857	0.00302492		0.00075	0.01525		3.50E-06	0.023
15117-96-1	U-235	pCi/g	3000	30	28	0.015	0.057	0.028825	0.01699064		0.013	0.022		1.90E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000	20	5	0.14	0.37	0.0835	0.10988152		0.0225	0.09		3.70E-04	0
7440-29-1	Th-232	pCi/g	2000	28	28	0.54	1.6	1.144642857	0.28324158					8.00E-04	1.6
7440-61-1	U-238	pCi/g	2000	30	30	0.49	1.4	0.840666667	0.20772882					7.00E-04	1.3
86954-36-1	Am-241	pCi/g	4000	20				0.046	0.00598243		0.0375	0.0575			0
Exposure Unit 2															
10028-17-8	Tritium (H-3)	pCi/g	200000	6				0.023333333	0.00129099		0.0225	0.025			0.35
10045-97-3	Cs-137	pCi/g	20	17	16	0.03	0.45	0.175	0.16498106		0.005	0.005		2.25E-02	0.24
10098-97-2	Sr-90	pCi/g	20	15	6	0.053	0.099	0.0378	0.02998083		0.015	0.025		4.95E-03	0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	16	16	11.53	22	19.970625	2.41836162					1.85E-01	30
13966-29-5	U-234	pCi/g	5000	15	15	0.4	1.1	0.698666667	0.24277758					2.20E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270	15	1	0.006	0.006	0.0027	0.0017454		0.001	0.005		1.14E-06	0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	15	15	0.42	0.97	0.737333333	0.20648302					1.94E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	15	15	0.41	1	0.67	0.2018486					1.00E-04	1.6
14274-82-9	Th-228	pCi/g	530	15	15	0.52	1.1	0.767333333	0.22400468					2.08E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520	2				0.040875	0.00159099		0.03975	0.042			0
15117-48-3	Pu-239	pCi/g	6000	15	5	0.005	0.012	0.00415	0.00296377		0.0015	0.005		2.00E-06	0.023
15117-96-1	U-235	pCi/g	3000	15	15	0.022	0.053	0.036866667	0.01205859					1.77E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000	15	15	0.57	1	0.770666667	0.14577216					5.00E-04	1.6
7440-61-1	U-238	pCi/g	2000	15	15	0.42	1.1	0.703333333	0.24182835					5.50E-04	1.3
86954-36-1	Am-241	pCi/g	4000												0
Exposure Unit 3															
10028-17-8	Tritium (H-3)	pCi/g	200000	2				0.0225	0.00353553		0.02	0.025			0.35
10045-97-3	Cs-137	pCi/g	20	116	68	0.018	3.09	0.288135991	0.5197518		0.005	0.0345		1.55E-01	0.24
10098-97-2	Sr-90	pCi/g	20	15	6	0.053	4.82	0.493	1.24734332		0.0175	0.3075		2.41E-01	0.1
10198-40-0	Co-60	pCi/g	700	6	6	0.03	2.6	0.638666667	0.98541071					3.71E-03	0
13966-00-2	K-40	pCi/g	119	31	31	15	25.9	22.02516129	2.30287193					2.18E-01	30
13966-29-5	U-234	pCi/g	5000	29	29	0.6	2.1	0.935655172	0.29854807					4.20E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270	13	1	0.006	0.006	0.004226923	0.00668445		0.00075	0.019225		1.14E-06	0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	89	89	0.51	2.78	1.116539326	0.40027107					5.56E-02	2.5
14119-32-5	Pu-241	pCi/g	190000	2	2	5.87	5.87	1.5275	0					3.09E-05	0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	33	33	0.52	2.57	1.03230303	0.44895549					2.58E-04	1.6
14274-82-9	Th-228	pCi/g	530	41	41	0.56	2.5	1.241731707	0.32280482					4.72E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520	12	2	0.43	25.7	2.207166667	7.39920556		0.0075	0.0505		1.69E-02	0
15117-48-3	Pu-239	pCi/g	6000	17	12	0.001	0.023	0.00835	0.00741954		0.00075	0.019225		3.83E-06	0.023
15117-96-1	U-235	pCi/g	3000	28	28	0.031	0.1	0.044910714	0.01608185					3.33E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000	102	102	0.51	2.73	1.360578431	0.39090353					1.37E-03	1.6
7440-61-1	U-238	pCi/g	2000	29	27	0.61	2	14.36634483	50.3102352		196	196		1.00E-03	1.3

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
86954-36-1	Am-241	pCi/g	4000	6	1	0.006	0.006	0.027083333	0.02523572		0.0125	0.0595		1.50E-06	0
Exposure Unit 4															
10028-17-8	Tritium (H-3)	pCi/g	200000	55	11	0.3	1.4	0.386772727	0.52838584		0.0225	1.525		7.00E-06	0.35
10045-97-3	Cs-137	pCi/g	20	379	267	0.01	6.99	0.441045119	0.86738624		0.0025	0.055		3.50E-01	0.24
10098-97-2	Sr-90	pCi/g	20	159	54	0.042	1.3	0.294147799	0.43054938		0.02	2.7		6.50E-02	0.1
10198-40-0	Co-60	pCi/g	700	262	6	0.023	0.1	0.022326145	0.01666891		0.004	0.055		1.43E-04	0
13966-00-2	K-40	pCi/g	119	201	201	14.97	33.1	20.26870647	2.71677406					2.78E-01	30
13966-29-5	U-234	pCi/g	5000	151	147	0.565	1.3	0.914529801	0.34097411		2.7	2.7		2.60E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3	48	3	0.033	0.066	0.01896875	0.00806071		0.0125	0.0375		5.84E-03	0
13981-16-3	Pu-238	pCi/g	5270	162	37	0.000337	0.0614	0.016044231	0.00864024		0.001	0.0325		1.17E-05	0.08
13981-37-8	Ni-63	pCi/g	104000	6				1.2475	2.1765E-08		1.2475	1.2475			0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	145	141	0.205	1.63	0.801706897	0.27159072		0.085	0.22		3.26E-02	2.5
14119-32-5	Pu-241	pCi/g	190000	131	67	1.13	6.56	1.997328244	1.57626778		0.525	3.25		3.45E-05	0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390	1	1	1.39	1.39	1.39						1.00E-03	2.5
14269-63-7	Th-230	pCi/g	9980	104	104	0.57	1.77	1.028384615	0.2681687					1.77E-04	1.6
14274-82-9	Th-228	pCi/g	530	104	104	0.59	13.7	1.575230769	2.44487553					2.58E-02	1.6
14331-83-0	Ac-228	pCi/g		41	41	0.94	1.4	1.135853659	0.12326751	41					1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000	1	1	0.06	0.06	0.06						3.00E-06	0
14681-59-5	Fe-55	pCi/g	55300	6				0.3425	0		0.3425	0.3425			0
14683-23-9	Eu-152	pCi/g	1520	68	2	0.066	0.09	0.039290441	0.01810045		0.02225	0.12		5.92E-05	0
15117-48-3	Pu-239	pCi/g	6000	158	38	0.00074	0.613	0.023260316	0.07243122		0.00075	0.022		1.02E-04	0.023
15117-96-1	U-235	pCi/g	3000	296	247	0.004	0.68	0.059560135	0.06495891		0.011325	0.21		2.27E-04	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000	47	17	0.06	0.31	0.100414894	0.1017691		0.015	0.2045		3.10E-04	0
7440-29-1	Th-232	pCi/g	2000	173	173	0.64	1.94	1.061190751	0.20484961					9.70E-04	1.6
7440-61-1	U-238	pCi/g	2000	295	288	0.09	3.42	0.878133898	0.40236056		0.2525	0.5875		1.71E-03	1.3
86954-36-1	Am-241	pCi/g	4000	155	14	0.047	0.133	0.042040323	0.02150318		0.009325	0.12675		3.33E-05	0
Exposure Unit 5															
10028-17-8	Tritium (H-3)	pCi/g	200000	2	1	0.057	0.057	0.025	0		0.025	0.025		2.85E-07	0.35
10045-97-3	Cs-137	pCi/g	20	6	6	0.03	0.53	0.158333333	0.18744777					2.65E-02	0.24
10098-97-2	Sr-90	pCi/g	20	6	5	0.028	0.059	0.01625	0.00720243		0.0175	0.0175		2.95E-03	0.1
10198-40-0	Co-60	pCi/g	700	1	1	0.04	0.04	0.04						5.71E-05	0
13966-00-2	K-40	pCi/g	119	8	8	19	23.6	20.85	1.81344187					1.98E-01	30
13966-29-5	U-234	pCi/g	5000	6	6	0.62	1.3	0.951666667	0.28999425					2.60E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270	6				0.00175	0.00082158		0.001	0.0025			0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	7	7	0.78	1.4	1.015714286	0.26968235					2.80E-02	2.5

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	6	6	0.58	0.96	0.706666667	0.14569374					9.62E-05	1.6
14274-82-9	Th-228	pCi/g	530	6	6	0.39	1.2	0.766666667	0.34191617					2.26E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000	2	2	0.04	0.11	0.075	0.04949747					5.50E-06	0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000	6	2	0.004	0.013	0.003416667	0.00470018		0.00125	0.00175		2.17E-06	0.023
15117-96-1	U-235	pCi/g	3000	6	6	0.027	0.082	0.0515	0.02440287					2.73E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000	6	6	0.42	1.1	0.763333333	0.30942958					5.50E-04	1.6
7440-61-1	U-238	pCi/g	2000	6	6	0.62	1.4	0.986666667	0.33524121					7.00E-04	1.3
86954-36-1	Am-241	pCi/g	4000												0
Exposure Unit 6															
10028-17-8	Tritium (H-3)	pCi/g	200000	19	1	1	1	0.422368421	0.00788254		0.4	0.425		5.00E-06	0.35
10045-97-3	Cs-137	pCi/g	20	370	214	0.0095	5.84	0.307240676	0.68320573		0.00275	0.045		2.92E-01	0.24
10098-97-2	Sr-90	pCi/g	20	328	136	0.039	28.1	0.316040396	1.57690197	1	0.015	0.21		1.41E+00	0.1
10198-40-0	Co-60	pCi/g	700	342	4	0.048	0.07	0.024300292	0.00881161		0.00245	0.045		1.00E-04	0
13966-00-2	K-40	pCi/g	119	356	356	13.72	28.2	21.19674157	2.22145151					2.37E-01	30
13966-29-5	U-234	pCi/g	5000	328	328	0.292	9.6	0.954021341	0.60173035					1.92E-03	1.2
13966-32-0	Na-22	pCi/g	16.4	202	3	0.012	0.068	0.02742203	0.01134345		0.00325	0.045		4.15E-03	0
13967-70-9	Cs-134	pCi/g	11.3	343	18	0.0057	0.11	0.018978936	0.00565247		0.00235	0.0375		9.73E-03	0
13981-16-3	Pu-238	pCi/g	5270	328	15	0.02	0.077	0.012898628	0.00472135		0.00075	0.04		1.46E-05	0.08
13981-37-8	Ni-63	pCi/g	104000	19				1.055263158	0.29751038		0.775	2.15			0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	173	164	0.31	7.1	1.433641618	1.30137228		0.4	2		1.42E-01	2.5
14119-32-5	Pu-241	pCi/g	190000	320	17	1.1	4.9	0.88515625	0.32645619		0.35	2.475		2.58E-05	0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	192	192	0.041	1.64	0.841598958	0.3278275					1.64E-04	1.6
14274-82-9	Th-228	pCi/g	530	192	174	0.42	2.53	1.104114583	0.39471285		0.1475	0.225		4.77E-03	1.6
14331-83-0	Ac-228	pCi/g		282	281	0.54	2.09	1.162083333	0.22910807	281	0.0875	0.0875			1.6
14336-70-0	Ni-59	pCi/g	268000	19	1	720	720	409.3421053	114.939121		207.5	550		2.69E-03	0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300	19	1	6	6	1.736842105	0.32780503		1.275	2.325		1.08E-04	0
14683-23-9	Eu-152	pCi/g	1520	360	18	0.024	2.84	0.152898819	0.22369196		0.0065	0.325		1.87E-03	0
15117-48-3	Pu-239	pCi/g	6000	324	27	0.002	0.116	0.010722222	0.00854912		0.001	0.0275		1.93E-05	0.023
15117-96-1	U-235	pCi/g	3000	328	257	0.012	0.73	0.045631098	0.05460028		0.0075	0.02375		2.43E-04	0.09
15262-20-1	Ra-228	pCi/g	40	148	148	0.54	2.09	1.189459459	0.26710538					5.23E-02	1.6
15585-10-1	Eu-154	pCi/g	1000	338	60	0.028	0.63	0.134585799	0.096692		0.00775	0.325		6.30E-04	0
7440-29-1	Th-232	pCi/g	2000	478	478	0.063	2.36	1.120979079	0.31278198					1.18E-03	1.6

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
7440-61-1	U-238	pCi/g	2000	335	335	0.242	8.6	0.877689552	0.54632731					4.30E-03	1.3
86954-36-1	Am-241	pCi/g	4000	320	24	0.023	0.86	0.029875781	0.04879101		0.00725	0.0525		2.15E-04	0
Exposure Unit 7															
10028-17-8	Tritium (H-3)	pCi/g	200000	8				0.02375	0.00133631		0.0225	0.025			0.35
10045-97-3	Cs-137	pCi/g	20	65	53	0.01	2.93	0.434276923	0.61273501		0.00375	0.023425		1.47E-01	0.24
10098-97-2	Sr-90	pCi/g	20	41	13	0.034	3.08	0.190256098	0.51044677		0.01	0.235		1.54E-01	0.1
10198-40-0	Co-60	pCi/g	700	2	2	0.04	0.04	0.04	0					5.71E-05	0
13966-00-2	K-40	pCi/g	119	35	35	16	24.27	19.47828571	1.95075926					2.04E-01	30
13966-29-5	U-234	pCi/g	5000	41	41	0.54	1.71	0.953170732	0.33085071					3.42E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3	1	1	0.04	0.04	0.04						3.54E-03	0
13981-16-3	Pu-238	pCi/g	5270	42	4	0.005	0.16	0.023119048	0.02179549		0.001	0.0625		3.04E-05	0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	35	35	0.55	2.16	0.9934	0.39634842					4.32E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	41	41	0.59	2.7	1.103170732	0.52109231					2.71E-04	1.6
14274-82-9	Th-228	pCi/g	530	52	52	0.67	2.69	1.289788462	0.45149031					5.08E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520	4	1	0.0875	0.0875	0.0530625	0.02332236		0.036	0.04575		5.76E-05	0
15117-48-3	Pu-239	pCi/g	6000	42	11	0.003	0.15	0.02139881	0.02849685		0.001	0.0525		2.50E-05	0.023
15117-96-1	U-235	pCi/g	3000	50	39	0.022	0.25	0.06276	0.05085589		0.016	0.15		8.33E-05	0.09
15262-20-1	Ra-228	pCi/g	40	11	11	1.01	2.87	1.56	0.56181848					7.18E-02	1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000	52	52	0.57	2.87	1.140961538	0.42212469					1.44E-03	1.6
7440-61-1	U-238	pCi/g	2000	50	50	0.55	3.56	1.1162	0.60974364					1.78E-03	1.3
86954-36-1	Am-241	pCi/g	4000	22	3	0.053	0.1	0.077534091	0.07439607		0.02275	0.28		2.50E-05	0
Exposure Unit 8															
10028-17-8	Tritium (H-3)	pCi/g	200000	157	48	-3.55	11.8	1.305517709	2.21946212		0.0575	1.75		5.90E-05	0.35
10045-97-3	Cs-137	pCi/g	20	180	55	-0.03	0.436	0.043559891	0.07118462		0.005	0.05335		2.18E-02	0.24
10098-97-2	Sr-90	pCi/g	20	156	67	-0.37991826	1.2505437	0.099306992	0.147265		0.0075	0.16975		6.25E-02	0.1
10198-40-0	Co-60	pCi/g	700	156	41	-0.0336	0.09558	0.040649336	0.04709661		0.0195	0.53		1.37E-04	0
13966-00-2	K-40	pCi/g	119	217	207	0.257	39.34	21.19626179	7.44327675		0.1844	0.23775		3.31E-01	30
13966-29-5	U-234	pCi/g	5000	155	155	0.285	1.518	0.763022581	0.24796537					3.04E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3	2				0.0375	0		0.0375	0.0375			0
13981-16-3	Pu-238	pCi/g	5270	155	63	-0.000758	0.115	0.02068629	0.01266916		0.001	0.064175		2.18E-05	0.08
13981-37-8	Ni-63	pCi/g	104000	146	77	-10.8	48.5	3.388744838	6.63292709		0.7725	2.75		4.66E-04	0
13981-41-4	Ba-133	pCi/g	667	63	20	-0.01	0.401	0.057509804	0.09771502		0.01725	0.058		6.01E-04	0
13981-52-7	Po-210	pCi/g													2.5

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
13982-63-3	Ra-226	pCi/g	50	9	9	0.68	0.85	0.758888889	0.05230785					1.70E-02	2.5
14119-32-5	Pu-241	pCi/g	190000	146	56	-5.40548892	8.61	0.626748663	1.29733965		0.245	1.700774305		4.53E-05	0
14119-33-6	Pu-240	pCi/g	18.5	51	10	-0.00180708	0.0178	0.003297081	0.00396011		0.000445	0.0157065		9.62E-04	0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	155	155	0.406	2.39	1.112916129	0.36622665					2.39E-04	1.6
14274-82-9	Th-228	pCi/g	530	155	155	0.704	1.865	1.21676	0.24632892					3.52E-03	1.6
14331-83-0	Ac-228	pCi/g		2	2	1.13	1.13	1.13	0	2					1.6
14336-70-0	Ni-59	pCi/g	268000	31	31	-5.04	58.1	37.704	21.1630827					2.17E-04	0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300	146	40	-0.445	30	2.308474359	3.64815168		0.3075	7.5		5.42E-04	0
14683-23-9	Eu-152	pCi/g	1520	150	68	-0.35	0.844	0.252876168	0.24476927		0.02025	0.3175		5.55E-04	0
15117-48-3	Pu-239	pCi/g	6000	155	43	-0.0148	0.101	0.012717616	0.00939972		0.000755	0.02925		1.68E-05	0.023
15117-96-1	U-235	pCi/g	3000	157	113	0.012	0.3399	0.044606529	0.04951981		0.0045	0.03575		1.13E-04	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000	150	42	-0.494	0.166	0.167187385	0.06317521		0.072375	0.25		1.66E-04	0
7440-29-1	Th-232	pCi/g	2000	157	157	0.51	1.842	1.188511465	0.26585203					9.21E-04	1.6
7440-61-1	U-238	pCi/g	2000	157	157	0.25	1.355	0.752740764	0.21990063					6.78E-04	1.3
86954-36-1	Am-241	pCi/g	4000	146	63	-0.0107	0.118	0.019760522	0.01219462		0.00625	0.0375		2.95E-05	0
Exposure Unit 9															
10028-17-8	Tritium (H-3)	pCi/g	200000	11	1	0.055	0.055	0.024772727	0.00075378		0.0225	0.025		2.75E-07	0.35
10045-97-3	Cs-137	pCi/g	20	541	304	0.012	5.864	0.164843033	0.46988861		0.0025	0.042425		2.93E-01	0.24
10098-97-2	Sr-90	pCi/g	20	337	94	0.035	1.05	0.212780415	0.10380143		0.02	0.215		5.25E-02	0.1
10198-40-0	Co-60	pCi/g	700	93				0.033736559	0.01075053		0.0225	0.05			0
13966-00-2	K-40	pCi/g	119	44	44	12.22	26.23	17.22931818	2.61698424					2.20E-01	30
13966-29-5	U-234	pCi/g	5000	54	53	0.29	1.3	0.652467593	0.18917007		0.01325	0.01325		2.60E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3	15				0.0375	7.271E-10		0.0375	0.0375			0
13981-16-3	Pu-238	pCi/g	5270	179	58	-0.000231	0.11	0.015903238	0.01721423		0.001	0.125		2.09E-05	0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	249	225	0.51	1.2	0.764859438	0.26989708		0.1	0.1		2.40E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	53	53	0.48	2.09	1.145660377	0.38613225					2.09E-04	1.6
14274-82-9	Th-228	pCi/g	530	55	55	0.72	2.86	1.567272727	0.52351891					5.40E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000	2	2	0.06	0.06	0.06	0					3.00E-06	0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520	101				0.044049505	0.02016116		0.025	0.075			0
15117-48-3	Pu-239	pCi/g	6000	185	70	-0.000122	0.613	0.033223082	0.08427333		0.001	0.09		1.02E-04	0.023
15117-96-1	U-235	pCi/g	3000	254	35	0.034	0.2	0.079562008	0.04047454		0.016	0.15		6.67E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
7440-29-1	Th-232	pCi/g	2000	360	276	0.63	2.76	1.091111111	0.58742144		0.075	0.225		1.38E-03	1.6
7440-61-1	U-238	pCi/g	2000	602	441	0.285	5.07	0.842569204	0.54118569		0.0075	0.5		2.54E-03	1.3
86954-36-1	Am-241	pCi/g	4000	185	16	0.029	0.15	0.039539189	0.02785917		0.02	0.2325		3.75E-05	0
Exposure Unit 10															
10028-17-8	Tritium (H-3)	pCi/g	200000	7	1	0.055	0.055	0.498571429	0.79698763		0.0225	1.665		2.75E-07	0.35
10045-97-3	Cs-137	pCi/g	20	80	22	0.0262	0.438	0.055823125	0.08226833		0.006	0.0485		2.19E-02	0.24
10098-97-2	Sr-90	pCi/g	20	12	7	0.036	0.511	0.044958333	0.04958107		0.0125	0.025		2.56E-02	0.1
10198-40-0	Co-60	pCi/g	700	3				0.030166667	0.00447446		0.025	0.03275			0
13966-00-2	K-40	pCi/g	119	14	14	16.25	25.2	19.695	2.67845176					2.12E-01	30
13966-29-5	U-234	pCi/g	5000	12	12	0.52	1.2	0.826	0.22472124					2.40E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270	12				0.006375	0.01140051		0.001	0.03075			0.08
13981-37-8	Ni-63	pCi/g	104000	3	1	5.9	5.9	1.32	0.41569219		1.08	1.08		5.67E-05	0
13981-41-4	Ba-133	pCi/g	667	1				0.025			0.025	0.025			0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	9	9	0.6	0.96	0.762222222	0.13414337					1.92E-02	2.5
14119-32-5	Pu-241	pCi/g	190000	3				0.756666667	0.39548493		0.3	0.985			0
14119-33-6	Pu-240	pCi/g	18.5	1	1	0.00285	0.00285	0.00285						1.54E-04	0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	12	12	0.5	2.39	1.086166667	0.64324035					2.39E-04	1.6
14274-82-9	Th-228	pCi/g	530	12	12	0.62	1.59	1.141666667	0.35728352					3.00E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300	3				2.395	3.55503428		0.3425	6.5			0
14683-23-9	Eu-152	pCi/g	1520	7	3	0.0875	0.332	0.151428571	0.13683846		0.0335	0.2025		2.18E-04	0
15117-48-3	Pu-239	pCi/g	6000	12	7	0.003	0.024	0.009808333	0.00867546		0.00125	0.01755		4.00E-06	0.023
15117-96-1	U-235	pCi/g	3000	12	12	0.018	0.076	0.0384	0.01690616					2.53E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000	3				0.175333333	0.01544412		0.1575	0.18425			0
7440-29-1	Th-232	pCi/g	2000	12	12	0.56	1.58	1.116666667	0.34618265					7.90E-04	1.6
7440-61-1	U-238	pCi/g	2000	12	12	0.5	1.1	0.798416667	0.20565923					5.50E-04	1.3
86954-36-1	Am-241	pCi/g	4000	3				0.019416667	0.01443376		0.00275	0.02775			0
Exposure Unit 11															
10028-17-8	Tritium (H-3)	pCi/g	200000	24	9	0.055	0.11	0.0284375	0.01738022		0.0225	0.025		5.50E-07	0.35
10045-97-3	Cs-137	pCi/g	20	184	22	0.04	1.2	0.071287772	0.16732346		0.005	0.0375		6.00E-02	0.24
10098-97-2	Sr-90	pCi/g	20	36	18	0.028	1.9	0.098416667	0.31235418		0.01	0.08		9.50E-02	0.1
10198-40-0	Co-60	pCi/g	700	145				0.037327586	0.00104811		0.03	0.0375			0
13966-00-2	K-40	pCi/g	119	193	193	10.01	26.5	15.7111399	2.61700603					2.23E-01	30
13966-29-5	U-234	pCi/g	5000	36	36	0.36	1.53	0.8075	0.24699769					3.06E-04	1.2
13966-32-0	Na-22	pCi/g	16.4	4				0.035	0.0057735		0.03	0.04			0
13967-70-9	Cs-134	pCi/g	11.3	141				0.037117021	0.00225566		0.023	0.0375			0
13981-16-3	Pu-238	pCi/g	5270	65	22	0.000016	0.0552	0.007814587	0.011906		0.00075	0.01525		1.05E-05	0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
13981-52-7	Po-210	pCi/g		1	1	1.35	1.35	1.35		1					2.5
13982-63-3	Ra-226	pCi/g	50	36	36	0.57	4	1.049916667	0.84411287					8.00E-02	2.5
14119-32-5	Pu-241	pCi/g	190000	4				0.75	0.02886751		0.725	0.775			0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390	1	1	1.31	1.31	1.31						9.42E-04	2.5
14269-63-7	Th-230	pCi/g	9980	36	36	0.37	1.45	0.896666667	0.22146267					1.45E-04	1.6
14274-82-9	Th-228	pCi/g	530	21	21	0.49	1.6	1.143809524	0.29237777					3.02E-03	1.6
14331-83-0	Ac-228	pCi/g		2	2	1.33	1.33	1.33	0	2					1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520	4				0.24875	0.0591784		0.1975	0.3			0
15117-48-3	Pu-239	pCi/g	6000	65	36	0.000504	0.613	0.041740781	0.1249164		0.00075	0.01225		1.02E-04	0.023
15117-96-1	U-235	pCi/g	3000	70	39	0.019	0.131	0.065881429	0.02739481		0.0575	0.115		4.37E-05	0.09
15262-20-1	Ra-228	pCi/g	40	3	3	0.809	1.33	1.156333333	0.30079949					3.33E-02	1.6
15585-10-1	Eu-154	pCi/g	1000	4				0.2225	0.03175426		0.195	0.25			0
7440-29-1	Th-232	pCi/g	2000	191	191	0.49	1.5	0.910837696	0.21279674					7.50E-04	1.6
7440-61-1	U-238	pCi/g	2000	223	210	0.285	5.07	0.766098655	0.62619181		0.12	0.2525		2.54E-03	1.3
86954-36-1	Am-241	pCi/g	4000	38				0.049355263	0.04673963		0.0075	0.225			0
Exposure Unit 12															
10028-17-8	Tritium (H-3)	pCi/g	200000	14	1	0.053	0.053	0.024642857	0.00090784		0.0225	0.025		2.65E-07	0.35
10045-97-3	Cs-137	pCi/g	20	64	13	0.03	0.17	0.032641406	0.03169691		0.0025	0.03		8.50E-03	0.24
10098-97-2	Sr-90	pCi/g	20	58	18	0.048	0.48	0.094284483	0.05626263		0.015	0.25		2.40E-02	0.1
10198-40-0	Co-60	pCi/g	700	40	2	0.062	0.095	0.02519375	0.00371349		0.01675	0.0325		1.36E-04	0
13966-00-2	K-40	pCi/g	119	61	61	17	24	20.56065574	1.76901844					2.02E-01	30
13966-29-5	U-234	pCi/g	5000	65	65	0.56	1.15	0.789046154	0.12961149					2.30E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3	40	2	0.048	0.052	0.0198	0.00266338		0.0145	0.025		4.60E-03	0
13981-16-3	Pu-238	pCi/g	5270	63	7	0.024	0.08	0.010869048	0.01425664		0.00075	0.0215		1.52E-05	0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g		1	1	0.773	0.773	0.773		1					2.5
13982-63-3	Ra-226	pCi/g	50	21	21	0.59	0.93	0.774714286	0.10051723					1.86E-02	2.5
14119-32-5	Pu-241	pCi/g	190000	40	3	2.4	4.4	1.014375	0.8002381		0.475	1.25		2.32E-05	0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390	1	1	0.818	0.818	0.818						5.88E-04	2.5
14269-63-7	Th-230	pCi/g	9980	21	21	0.45	1.2	0.843809524	0.22835228					1.20E-04	1.6
14274-82-9	Th-228	pCi/g	530	21	21	0.53	1.72	1.043333333	0.32485894					3.25E-03	1.6
14331-83-0	Ac-228	pCi/g		40	40	0.98	1.69	1.31375	0.14680682	40					1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520	40	3	0.089	0.09	0.0368125	0.00490249		0.03	0.0475		5.92E-05	0
15117-48-3	Pu-239	pCi/g	6000	64	15	0.003	0.19	0.012871094	0.03142098		0.00075	0.0175		3.17E-05	0.023
15117-96-1	U-235	pCi/g	3000	65	55	0.021	0.086	0.033179231	0.01974508		0.008	0.01925		2.87E-05	0.09
15262-20-1	Ra-228	pCi/g	40	1	1	1.32	1.32	1.32						3.30E-02	1.6

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
15585-10-1	Eu-154	pCi/g	1000	38	12	0.11	0.4	0.086513158	0.10484309		0.02	0.0325		4.00E-04	0
7440-29-1	Th-232	pCi/g	2000	61	61	0.4	1.69	1.202786885	0.26290766					8.45E-04	1.6
7440-61-1	U-238	pCi/g	2000	65	65	0.55	1.06	0.807553846	0.1111539					5.30E-04	1.3
86954-36-1	Am-241	pCi/g	4000	40	1	0.12	0.12	0.045875	0.00600614		0.035	0.0575		3.00E-05	0
Exposure Unit 13															
10028-17-8	Tritium (H-3)	pCi/g	200000	7				0.025	4.0646E-10		0.025	0.025			0.35
10045-97-3	Cs-137	pCi/g	20	8	4	0.06	0.17	0.0671875	0.06496479		0.015	0.02		8.50E-03	0.24
10098-97-2	Sr-90	pCi/g	20	8	5	0.053	0.22	0.06975	0.07261149		0.0175	0.025		1.10E-02	0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	8	8	15	20	18	1.77281052					1.68E-01	30
13966-29-5	U-234	pCi/g	5000	8	8	0.6	0.74	0.67125	0.04673252					1.48E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270	8				0.0025	0.00114174		0.001	0.005			0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	8	8	0.55	1	0.805	0.13533028					2.00E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	8	8	0.64	1	0.79625	0.12339686					1.00E-04	1.6
14274-82-9	Th-228	pCi/g	530	1	1	0.89	0.89	0.89						1.68E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000	8	2	0.005	0.008	0.00321875	0.00223382		0.001	0.0025		1.33E-06	0.023
15117-96-1	U-235	pCi/g	3000	8	8	0.03	0.054	0.041625	0.00957583					1.80E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000	8	8	0.95	1.6	1.21875	0.19988836					8.00E-04	1.6
7440-61-1	U-238	pCi/g	2000	8	8	0.66	0.78	0.72625	0.03814914					3.90E-04	1.3
86954-36-1	Am-241	pCi/g	4000												0
Exposure Unit 14															
10028-17-8	Tritium (H-3)	pCi/g	200000												0.35
10045-97-3	Cs-137	pCi/g	20	4	4	0.04	0.29	0.1725	0.13622897					1.45E-02	0.24
10098-97-2	Sr-90	pCi/g	20	4	4	0.031	0.11	0.0715	0.04682236					5.50E-03	0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	4	4	9.3	17	12.075	3.37971892					1.43E-01	30
13966-29-5	U-234	pCi/g	5000	4	4	0.46	0.69	0.6075	0.10111874					1.38E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270	4				0.0015625	0.000375		0.001	0.00175			0.08
13981-37-8	Ni-63	pCi/g	104000												0

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	4	4	0.4	0.7	0.545	0.12261049					1.40E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	4	4	0.5	0.61	0.5775	0.05188127					6.11E-05	1.6
14274-82-9	Th-228	pCi/g	530	4	4	0.8	1	0.9	0.08164966					1.89E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000	4	3	0.003	0.012	0.00675	0.00607591		0.002	0.002		2.00E-06	0.023
15117-96-1	U-235	pCi/g	3000	4	4	0.024	0.032	0.02625	0.00386221					1.07E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000	4	4	0.77	1	0.9	0.11803954					5.00E-04	1.6
7440-61-1	U-238	pCi/g	2000	4	4	0.51	0.79	0.655	0.11445523					3.95E-04	1.3
86954-36-1	Am-241	pCi/g	4000												0
Exposure Unit 15															
10028-17-8	Tritium (H-3)	pCi/g	200000												0.35
10045-97-3	Cs-137	pCi/g	20	6	6	0.03	0.38	0.15	0.12066483					1.90E-02	0.24
10098-97-2	Sr-90	pCi/g	20	6	6	0.047	0.12	0.071166667	0.04642593					6.00E-03	0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	6	6	14	19	16.66666667	1.96638416					1.60E-01	30
13966-29-5	U-234	pCi/g	5000	6	6	0.63	1.1	0.801666667	0.17702166					2.20E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270	6				0.001166667	0.00040825		0.00075	0.00175			0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	6	6	0.57	1.4	0.805	0.29991666					2.80E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	6	6	0.59	1.3	0.821666667	0.26656456					1.30E-04	1.6
14274-82-9	Th-228	pCi/g	530	6	6	0.66	2.1	1.226666667	0.47693466					3.96E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000	6	6	0.004	0.029	0.007916667	0.01056488					4.83E-06	0.023
15117-96-1	U-235	pCi/g	3000	6	6	0.035	0.069	0.0445	0.01261348					2.30E-05	0.09

Table E-4
Data Usability Results for Radionuclides in Surface Soil (0 - 2 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000	6	6	0.71	1.9	1.06	0.4304881					9.50E-04	1.6
7440-61-1	U-238	pCi/g	2000	6	6	0.68	1.2	0.846666667	0.18790068					6.00E-04	1.3
86954-36-1	Am-241	pCi/g	4000												0
Exposure Unit 16															
10028-17-8	Tritium (H-3)	pCi/g	200000												0.35
10045-97-3	Cs-137	pCi/g	20	2	2	0.09	0.09	0.09	0					4.50E-03	0.24
10098-97-2	Sr-90	pCi/g	20	2	2	0.053	0.08	0.02375	0.00176777					4.00E-03	0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	2	2	15	16	15.5	0.70710678					1.34E-01	30
13966-29-5	U-234	pCi/g	5000	2	2	0.66	1.3	0.98	0.45254834					2.60E-04	1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270	2				0.0015	0.00035355		0.00125	0.00175			0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	2	2	0.7	1.6	1.15	0.6363961					3.20E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980	2	2	0.69	0.81	0.75	0.08485281					8.12E-05	1.6
14274-82-9	Th-228	pCi/g	530	2	2	0.97	1.1	1.035	0.09192388					2.08E-03	1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000	2	1	0.004	0.004	0.002625	0.00194454		0.00125	0.00125		6.67E-07	0.023
15117-96-1	U-235	pCi/g	3000	2	2	0.041	0.072	0.0565	0.02192031					2.40E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000	2	2	0.74	1	0.87	0.18384776					5.00E-04	1.6
7440-61-1	U-238	pCi/g	2000	2	2	0.72	1.3	1.01	0.41012193					6.50E-04	1.3
86954-36-1	Am-241	pCi/g	4000												0

CAS = Chemical Abstract Service
pCi/g = picocurie per gram
PRG = preliminary remediation goal

Table E-5
Data Usability Results for Radionuclides in Soil (2 - 4 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
Exposure Unit 4															
10028-17-8	Tritium (H-3)	pCi/g	200000												0.35
10045-97-3	Cs-137	pCi/g	20	3	1	0.05	0.05	0.02	0.02598076		0.005	0.005		2.50E-03	0.24
10098-97-2	Sr-90	pCi/g	20												0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	3	3	17.99	19.59	18.6133333	0.85652398					1.65E-01	30
13966-29-5	U-234	pCi/g	5000												1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270												0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	3	3	1.48	1.63	1.57333333	0.08144528					3.26E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980												1.6
14274-82-9	Th-228	pCi/g	530												1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000												0.023
15117-96-1	U-235	pCi/g	3000	3	3	0.09	0.1	0.09666667	0.0057735					3.33E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000												1.6
7440-61-1	U-238	pCi/g	2000												1.3
86954-36-1	Am-241	pCi/g	4000												0
Exposure Unit 7															
10028-17-8	Tritium (H-3)	pCi/g	200000												0.35
10045-97-3	Cs-137	pCi/g	20	3				0.17	0.28578838		0.005	0.5			0.24
10098-97-2	Sr-90	pCi/g	20												0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	3	3	15.78	18.26	16.9766667	1.24226943					1.53E-01	30
13966-29-5	U-234	pCi/g	5000												1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270												0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	3	3	1.53	1.86	1.65666667	0.17785762					3.72E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0

Table E-5
Data Usability Results for Radionuclides in Soil (2 - 4 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980												1.6
14274-82-9	Th-228	pCi/g	530												1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000												0.023
15117-96-1	U-235	pCi/g	3000	3	3	0.09	0.11	0.1	0.01					3.67E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000												1.6
7440-61-1	U-238	pCi/g	2000												1.3
86954-36-1	Am-241	pCi/g	4000												0

CAS = Chemical Abstract Service
pCi/g = picocurie per gram
PRG = preliminary remediation goal

Table E-6
Data Usability Results for Radionuclides in Soil (4 - 6 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
Exposure Unit 4															
10028-17-8	Tritium (H-3)	pCi/g	200000												0.35
10045-97-3	Cs-137	pCi/g	20	3	1	0.01	0.01	0.006666667	0.002886751		0.005	0.005		5.00E-04	0.24
10098-97-2	Sr-90	pCi/g	20												0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	3	3	17.21	19.02	17.95	0.949052159					1.60E-01	30
13966-29-5	U-234	pCi/g	5000												1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270												0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	3	3	0.19	1.86	1.173333333	0.873632264					3.72E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980												1.6
14274-82-9	Th-228	pCi/g	530												1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000												0.023
15117-96-1	U-235	pCi/g	3000	3	3	0.09	0.11	0.1	0.01					3.67E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000												1.6
7440-61-1	U-238	pCi/g	2000												1.3
86954-36-1	Am-241	pCi/g	4000												0
Exposure Unit 7															
10028-17-8	Tritium (H-3)	pCi/g	200000												0.35
10045-97-3	Cs-137	pCi/g	20	5				0.005	7.36275E-11		0.005	0.005			0.24
10098-97-2	Sr-90	pCi/g	20												0.1
10198-40-0	Co-60	pCi/g	700												0
13966-00-2	K-40	pCi/g	119	5	5	15.57	18.37	16.816	1.190915614					1.54E-01	30
13966-29-5	U-234	pCi/g	5000												1.2
13966-32-0	Na-22	pCi/g	16.4												0
13967-70-9	Cs-134	pCi/g	11.3												0
13981-16-3	Pu-238	pCi/g	5270												0.08
13981-37-8	Ni-63	pCi/g	104000												0
13981-41-4	Ba-133	pCi/g	667												0
13981-52-7	Po-210	pCi/g													2.5
13982-63-3	Ra-226	pCi/g	50	5	5	1.43	1.89	1.604	0.17980545					3.78E-02	2.5
14119-32-5	Pu-241	pCi/g	190000												0

Table E-6
Data Usability Results for Radionuclides in Soil (4 - 6 ft)

CAS Number	Analyte	Units	PRG	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG	Minimum Detection Limit	Maximum Detection Limit	Minimum Detection Limit > PRG	Maximum Result/ PRG	Background Value
14119-33-6	Pu-240	pCi/g	18.5												0
14255-04-0	Pb-210	pCi/g	1390												2.5
14269-63-7	Th-230	pCi/g	9980												1.6
14274-82-9	Th-228	pCi/g	530												1.6
14331-83-0	Ac-228	pCi/g													1.6
14336-70-0	Ni-59	pCi/g	268000												0
14391-16-3	Eu-155	pCi/g	20000												0
14681-59-5	Fe-55	pCi/g	55300												0
14683-23-9	Eu-152	pCi/g	1520												0
15117-48-3	Pu-239	pCi/g	6000												0.023
15117-96-1	U-235	pCi/g	3000	5	5	0.09	0.11	0.098	0.0083666					3.67E-05	0.09
15262-20-1	Ra-228	pCi/g	40												1.6
15585-10-1	Eu-154	pCi/g	1000												0
7440-29-1	Th-232	pCi/g	2000												1.6
7440-61-1	U-238	pCi/g	2000												1.3
86954-36-1	Am-241	pCi/g	4000												0

CAS = Chemical Abstract Service
pCi/g = picocurie per gram
PRG = preliminary remediation goal

Table E-7
Data Usability Results for Radionuclides in Shallow Groundwater

CAS Number	Analyte	Units	PRG WT	PRG WA	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG WT	Samples Exceeding PRG WA	Minimum Detection Limit > PRG	Maximum Result/ PRG WT	Maximum Result/ PRG WA
Exposure Unit 4															
10028-17-8	Tritium (H-3)	pCi/L	2E+08	4.99E+09	42	42	-393	1099	171.89048	364.220342				5.495E-06	2.2024E-07
10045-97-3	Cs-137	pCi/L	600000	1050	2	2	1.64	1.64	1.64	0				2.7333E-06	0.0015619
10198-40-0	Co-60	pCi/L	1000000	3760	2	2	1.66	1.66	1.66	0				0.00000166	0.00044149
13966-00-2	K-40	pCi/L	1930000	2900	2	2	34.7	34.7	34.7	0				1.7979E-05	0.01196552
13966-02-4	Be-7	pCi/L													
13966-29-5	U-234	pCi/L	400000	202											
13966-31-9	Mn-54	pCi/L													
13966-32-0	Na-22	pCi/L	25.3	3.56											
13967-48-1	Ruthenium-106, Dissolved	pCi/L													
13967-70-9	Cs-134	pCi/L	326000	518	2	2	1.88	1.88	1.88	0				5.7669E-06	0.00362934
13968-55-3	U-233/234	pCi/L	400000	200	2	2	1.98	1.98	1.98	0				0.00000495	0.0099
13981-50-5	Co-57	pCi/L			2	2	1.31	1.31	1.31	0	2	2			
13982-63-3	Ra-226	pCi/L	8000	10.2	2	2	25.5	25.5	25.5	0		2		0.0031875	2.5
13982-70-2	Uranium-236, Dissolved	pCi/L													
14234-35-6	Sb-125	pCi/L	6970000	367000											
14255-04-0	Pb-210	pCi/L	292000	601	2	2	366	366	366	0				0.00125342	0.60898502
14269-63-7	Th-230	pCi/L	452000	2570											
14274-82-9	Th-228	pCi/L	63300	374											
14331-83-0	Ac-228	pCi/L			2	2	7.2	7.2	7.2	0	2	2			
14391-16-3	Eu-155	pCi/L	30000000	264000											
14391-76-5	Silver-110m, Dissolved	pCi/L													
14683-23-9	Eu-152	pCi/L	2550000	25500											
14733-03-0	Bi-214	pCi/L			2	2	3.1	3.1	3.1	0	2	2			
14913-49-6	Bi-212	pCi/L			2	2	12.2	12.2	12.2	0	2	2			
14913-50-9	Thallium-208	pCi/L													
15065-10-8	Th-234	pCi/L			2	2	51	51	51	0	2	2			
15067-28-4	Pb-214	pCi/L			2	2	3.23	3.23	3.23	0	2	2			
15092-94-1	Pb-212	pCi/L			2	2	2.46	2.46	2.46	0	2	2			
15117-96-1	U-235	pCi/L	400000	217	4	4	0.09	9.81	4.95	5.61184462				2.4525E-05	0.04520737
15262-20-1	Ra-228	pCi/L	7000	8.49											
15585-10-1	Eu-154	pCi/L	2000000	21600											
7440-29-1	Th-232	pCi/L	50000	304											
7440-61-1	U-238	pCi/L	400000	223	2	2	2.02	2.02	2.02	0				0.00000505	0.0090583
86954-36-1	Am-241	pCi/L	200000	438											
UKN093	Gross alpha, Decanted	pCi/L													
UKN094	Gross alpha, Dissolved	pCi/L			2	2	2.18	2.18	2.18	0	2	2			
UKN095	Gross alpha, Total	pCi/L													
UKN097	Gross beta, Decanted	pCi/L													
UKN098	Gross beta, Dissolved	pCi/L			2	2	8.98	8.98	8.98	0	2	2			
UKN099	Gross beta, Total	pCi/L													
Exposure Unit 5															
10028-17-8	Tritium (H-3)	pCi/L	2E+08	4.99E+09											
10045-97-3	Cs-137	pCi/L	600000	1050	1	1	1.25	1.25	1.25					2.0833E-06	0.00119048
10198-40-0	Co-60	pCi/L	1000000	3760	1	1	1.42	1.42	1.42					0.00000142	0.00037766
13966-00-2	K-40	pCi/L	1930000	2900	1	1	13.1	13.1	13.1					6.7876E-06	0.00451724
13966-02-4	Be-7	pCi/L													
13966-29-5	U-234	pCi/L	400000	202											

Table E-7
Data Usability Results for Radionuclides in Shallow Groundwater

CAS Number	Analyte	Units	PRG WT	PRG WA	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG WT	Samples Exceeding PRG WA	Minimum Detection Limit > PRG	Maximum Result/ PRG WT	Maximum Result/ PRG WA
13966-31-9	Mn-54	pCi/L			1	1	1.23	1.23	1.23		1	1			
13966-32-0	Na-22	pCi/L	25.3	3.56	1	1	1.4	1.4	1.4					0.05533597	0.39325843
13967-48-1	Ruthenium-106, Dissolved	pCi/L													
13967-70-9	Cs-134	pCi/L	326000	518	1	1	1.56	1.56	1.56					4.7853E-06	0.00301158
13968-55-3	U-233/234	pCi/L	400000	200											
13981-50-5	Co-57	pCi/L			1	1	0.528	0.528	0.528		1	1			
13982-63-3	Ra-226	pCi/L	8000	10.2											
13982-70-2	Uranium-236, Dissolved	pCi/L													
14234-35-6	Sb-125	pCi/L	6970000	367000											
14255-04-0	Pb-210	pCi/L	292000	601											
14269-63-7	Th-230	pCi/L	452000	2570											
14274-82-9	Th-228	pCi/L	63300	374											
14331-83-0	Ac-228	pCi/L													
14391-16-3	Eu-155	pCi/L	30000000	264000											
14391-76-5	Silver-110m, Dissolved	pCi/L													
14683-23-9	Eu-152	pCi/L	2550000	25500	1	1	3.21	3.21	3.21					1.2588E-06	0.00012588
14733-03-0	Bi-214	pCi/L													
14913-49-6	Bi-212	pCi/L													
14913-50-9	Thallium-208	pCi/L													
15065-10-8	Th-234	pCi/L													
15067-28-4	Pb-214	pCi/L													
15092-94-1	Pb-212	pCi/L													
15117-96-1	U-235	pCi/L	400000	217											
15262-20-1	Ra-228	pCi/L	7000	8.49											
15585-10-1	Eu-154	pCi/L	2000000	21600	1	1	4.12	4.12	4.12					0.00000206	0.00019074
7440-29-1	Th-232	pCi/L	50000	304											
7440-61-1	U-238	pCi/L	400000	223											
86954-36-1	Am-241	pCi/L	200000	438											
UKN093	Gross alpha, Decanted	pCi/L													
UKN094	Gross alpha, Dissolved	pCi/L			1	1	3.84	3.84	3.84		1	1			
UKN095	Gross alpha, Total	pCi/L													
UKN097	Gross beta, Decanted	pCi/L													
UKN098	Gross beta, Dissolved	pCi/L			1	1	5.53	5.53	5.53		1	1			
UKN099	Gross beta, Total	pCi/L													
Exposure Unit 6															
10028-17-8	Tritium (H-3)	pCi/L	2E+08	4.99E+09	45	45	-393	500	79.492667	237.842221				0.0000025	1.002E-07
10045-97-3	Cs-137	pCi/L	600000	1050	19	17	-3.02	14.5	2.6405882	4.74152142				2.4167E-05	0.01380952
10198-40-0	Co-60	pCi/L	1000000	3760	11	11	-1.4	15.2	4.5245455	5.69649079				0.0000152	0.00404255
13966-00-2	K-40	pCi/L	1930000	2900	7	7	-15	215	57	74.762446				0.0001114	0.07413793
13966-02-4	Be-7	pCi/L			1	1	26.5	26.5	26.5		1	1			
13966-29-5	U-234	pCi/L	400000	202											
13966-31-9	Mn-54	pCi/L			4	4	0.812	2.16	1.453	0.6410689	4	4			
13966-32-0	Na-22	pCi/L	25.3	3.56	3	3	0.821	1.51	1.1536667	0.34510916				0.05968379	0.4241573
13967-48-1	Ruthenium-106, Dissolved	pCi/L			1	1	16	16	16		1	1			
13967-70-9	Cs-134	pCi/L	326000	518	10	10	-2.5	20.7	6.669	7.61919134				6.3497E-05	0.03996139
13968-55-3	U-233/234	pCi/L	400000	200	1	1	4.59	4.59	4.59					1.1475E-05	0.02295
13981-50-5	Co-57	pCi/L			10	10	-1.5	9.5	2.7682	3.78618324	10	10			
13982-63-3	Ra-226	pCi/L	8000	10.2	10	10	-0.06	184	35.36836	63.439895		3		0.023	18.0392157

Table E-7
Data Usability Results for Radionuclides in Shallow Groundwater

CAS Number	Analyte	Units	PRG WT	PRG WA	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG WT	Samples Exceeding PRG WA	Minimum Detection Limit > PRG	Maximum Result/ PRG WT	Maximum Result/ PRG WA
13982-70-2	Uranium-236, Dissolved	pCi/L													
14234-35-6	Sb-125	pCi/L	6970000	367000	1	1	6.28	6.28	6.28					9.01E-07	1.7112E-05
14255-04-0	Pb-210	pCi/L	292000	601	3	3	73.448	2810	1094.1493	1494.85908		1		0.00962329	4.67554077
14269-63-7	Th-230	pCi/L	452000	2570	2	2	0.0058	0.147	0.0764	0.09984348				3.2522E-07	5.7198E-05
14274-82-9	Th-228	pCi/L	63300	374	2	2	0.0222	0.586	0.3041	0.3986668				9.2575E-06	0.00156684
14331-83-0	Ac-228	pCi/L			4	3	14.3	56	32.633333	21.3007825	3	3			
14391-16-3	Eu-155	pCi/L	30000000	264000	1	1	6.91	6.91	6.91					2.3033E-07	2.6174E-05
14391-76-5	Silver-110m, Dissolved	pCi/L			1	1	3.58	3.58	3.58		1	1			
14683-23-9	Eu-152	pCi/L	2550000	25500	4	4	2.26	6.04	4.0275	1.73476944				2.3686E-06	0.00023686
14733-03-0	Bi-214	pCi/L			4	4	15.4	103	44.30125	40.0175546	4	4			
14913-49-6	Bi-212	pCi/L			3	3	41.1	93.8	62.9	27.5032725	3	3			
14913-50-9	Thallium-208	pCi/L			4	4	-0.5	12.6	5.4979	5.60357758	4	4			
15065-10-8	Th-234	pCi/L			4	4	-2	384	160.425	167.219584	4	4			
15067-28-4	Pb-214	pCi/L			4	4	12.9	120	50.054	48.4054397	4	4			
15092-94-1	Pb-212	pCi/L			4	4	-0.4	24.2	10.275	10.2590074	4	4			
15117-96-1	U-235	pCi/L	400000	217	5	5	0.153	77.7	24.1046	32.5863453				0.00019425	0.35806452
15262-20-1	Ra-228	pCi/L	7000	8.49	7	7	-0.059	1.03	0.5195714	0.3598763				0.00014714	0.1213192
15585-10-1	Eu-154	pCi/L	2000000	21600	4	4	2.39	4.42	3.385	0.82987951				0.00000221	0.00020463
7440-29-1	Th-232	pCi/L	50000	304	2	2	0.00193	0.662	0.331965	0.46673997				0.00001324	0.00217763
7440-61-1	U-238	pCi/L	400000	223	1	1	4.24	4.24	4.24					0.0000106	0.01901345
86954-36-1	Am-241	pCi/L	200000	438	1	1	10.4	10.4	10.4					0.000052	0.02374429
UKN093	Gross alpha, Decanted	pCi/L													
UKN094	Gross alpha, Dissolved	pCi/L			33	33	0.3	25.7	6.1057273	4.40315466	33	33			
UKN095	Gross alpha, Total	pCi/L			2	2	7.38	42.3	24.84	24.6921688	2	2			
UKN097	Gross beta, Decanted	pCi/L													
UKN098	Gross beta, Dissolved	pCi/L			33	33	-5	33.7	6.7581212	5.86016245	33	33			
UKN099	Gross beta, Total	pCi/L			2	2	7.03	49.5	28.265	30.030825	2	2			
Exposure Unit 7															
10028-17-8	Tritium (H-3)	pCi/L	2E+08	4.99E+09	54	50	-120	500	79.029	158.387692				0.0000025	1.002E-07
10045-97-3	Cs-137	pCi/L	600000	1050	29	27	-5.61	14.8	3.3795185	5.7038933				2.4667E-05	0.01409524
10198-40-0	Co-60	pCi/L	1000000	3760	18	18	0.839	16.7	5.7136111	6.16991745				0.0000167	0.00444149
13966-00-2	K-40	pCi/L	1930000	2900	18	18	5	418	121.78333	152.073207				0.00021658	0.14413793
13966-02-4	Be-7	pCi/L													
13966-29-5	U-234	pCi/L	400000	202											
13966-31-9	Mn-54	pCi/L			7	7	0.802	1.48	1.1382857	0.27725242	7	7			
13966-32-0	Na-22	pCi/L	25.3	3.56	7	7	0.844	1.64	1.2278571	0.29915572				0.06482213	0.46067416
13967-48-1	Ruthenium-106, Dissolved	pCi/L													
13967-70-9	Cs-134	pCi/L	326000	518	18	18	0.941	19.6	6.5056111	7.12798674				6.0123E-05	0.03783784
13968-55-3	U-233/234	pCi/L	400000	200	1	1	20	20	20					0.00005	0.1
13981-50-5	Co-57	pCi/L			18	18	0.552	9.08	3.3827778	3.51697618	18	18			
13982-63-3	Ra-226	pCi/L	8000	10.2	23	23	-0.165	206	47.646826	79.3266977		10		0.02575	20.1960784
13982-70-2	Uranium-236, Dissolved	pCi/L													
14234-35-6	Sb-125	pCi/L	6970000	367000											
14255-04-0	Pb-210	pCi/L	292000	601	11	11	5	2940	677.45455	789.21624		3		0.01006849	4.89184692
14269-63-7	Th-230	pCi/L	452000	2570											
14274-82-9	Th-228	pCi/L	63300	374											
14331-83-0	Ac-228	pCi/L			11	11	5	67.2	36.767273	28.7777373	11	11			
14391-16-3	Eu-155	pCi/L	30000000	264000											

Table E-7
Data Usability Results for Radionuclides in Shallow Groundwater

CAS Number	Analyte	Units	PRG WT	PRG WA	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG WT	Samples Exceeding PRG WA	Minimum Detection Limit > PRG	Maximum Result/ PRG WT	Maximum Result/ PRG WA
14391-76-5	Silver-110m, Dissolved	pCi/L													
14683-23-9	Eu-152	pCi/L	2550000	25500	7	7	2.13	4.05	2.9785714	0.61121269				1.5882E-06	0.00015882
14733-03-0	Bi-214	pCi/L			11	11	2.49	165	29.614545	46.7458769	11	11			
14913-49-6	Bi-212	pCi/L			11	11	3	112	60.410909	48.7927586	11	11			
14913-50-9	Thallium-208	pCi/L			6	6	13	16.4	14.666667	1.1147496	6	6			
15065-10-8	Th-234	pCi/L			11	11	5	384	175.56364	138.738245	11	11			
15067-28-4	Pb-214	pCi/L			11	11	2.36	162	28.523636	45.8253411	11	11			
15092-94-1	Pb-212	pCi/L			11	11	1.78	26.2	12.710909	10.0667388	11	11			
15117-96-1	U-235	pCi/L	400000	217	12	12	0.9	75.8	38.43	33.4435128				0.0001895	0.34930876
15262-20-1	Ra-228	pCi/L	7000	8.49	12	12	-0.104	0.682	0.2010833	0.20861424				9.7429E-05	0.0803298
15585-10-1	Eu-154	pCi/L	2000000	21600	7	7	2.44	4.81	3.6071429	0.90759231				2.405E-06	0.00022269
7440-29-1	Th-232	pCi/L	50000	304											
7440-61-1	U-238	pCi/L	400000	223	1	1	17.9	17.9	17.9					0.00004475	0.08026906
86954-36-1	Am-241	pCi/L	200000	438											
UKN093	Gross alpha, Decanted	pCi/L			1	1	6.9	6.9	6.9		1	1			
UKN094	Gross alpha, Dissolved	pCi/L			51	50	-2.14	27.9	5.7888	6.43058744	50	50			
UKN095	Gross alpha, Total	pCi/L													
UKN097	Gross beta, Decanted	pCi/L			1	1	6.7	6.7	6.7		1	1			
UKN098	Gross beta, Dissolved	pCi/L			51	51	-8.84	28	5.3851176	6.23069965	51	51			
UKN099	Gross beta, Total	pCi/L													
Exposure Unit 8															
10028-17-8	Tritium (H-3)	pCi/L	2E+08	4.99E+09	3	3	-61	-46.2	-51.6	8.17067929				-2.31E-07	-9.259E-09
10045-97-3	Cs-137	pCi/L	600000	1050	1	1	0.335	0.335	0.335					5.5833E-07	0.00031905
10198-40-0	Co-60	pCi/L	1000000	3760											
13966-00-2	K-40	pCi/L	1930000	2900											
13966-02-4	Be-7	pCi/L													
13966-29-5	U-234	pCi/L	400000	202											
13966-31-9	Mn-54	pCi/L													
13966-32-0	Na-22	pCi/L	25.3	3.56											
13967-48-1	Ruthenium-106, Dissolved	pCi/L													
13967-70-9	Cs-134	pCi/L	326000	518											
13968-55-3	U-233/234	pCi/L	400000	200											
13981-50-5	Co-57	pCi/L													
13982-63-3	Ra-226	pCi/L	8000	10.2											
13982-70-2	Uranium-236, Dissolved	pCi/L													
14234-35-6	Sb-125	pCi/L	6970000	367000											
14255-04-0	Pb-210	pCi/L	292000	601											
14269-63-7	Th-230	pCi/L	452000	2570											
14274-82-9	Th-228	pCi/L	63300	374											
14331-83-0	Ac-228	pCi/L													
14391-16-3	Eu-155	pCi/L	30000000	264000											
14391-76-5	Silver-110m, Dissolved	pCi/L													
14683-23-9	Eu-152	pCi/L	2550000	25500											
14733-03-0	Bi-214	pCi/L													
14913-49-6	Bi-212	pCi/L													
14913-50-9	Thallium-208	pCi/L													
15065-10-8	Th-234	pCi/L													
15067-28-4	Pb-214	pCi/L													

Table E-7
Data Usability Results for Radionuclides in Shallow Groundwater

CAS Number	Analyte	Units	PRG WT	PRG WA	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG WT	Samples Exceeding PRG WA	Minimum Detection Limit > PRG	Maximum Result/ PRG WT	Maximum Result/ PRG WA
15092-94-1	Pb-212	pCi/L													
15117-96-1	U-235	pCi/L	400000	217											
15262-20-1	Ra-228	pCi/L	7000	8.49											
15585-10-1	Eu-154	pCi/L	2000000	21600											
7440-29-1	Th-232	pCi/L	50000	304											
7440-61-1	U-238	pCi/L	400000	223											
86954-36-1	Am-241	pCi/L	200000	438											
UKN093	Gross alpha, Decanted	pCi/L													
UKN094	Gross alpha, Dissolved	pCi/L			4	4	-0.3	2	0.646	1.10715732	4	4			
UKN095	Gross alpha, Total	pCi/L													
UKN097	Gross beta, Decanted	pCi/L													
UKN098	Gross beta, Dissolved	pCi/L			4	4	1.03	4	2.6825	1.41039888	4	4			
UKN099	Gross beta, Total	pCi/L													
Exposure Unit 9															
10028-17-8	Tritium (H-3)	pCi/L	2E+08	4.99E+09	24	24	-133	434	128.51667	203.764488				0.00000217	8.6974E-08
10045-97-3	Cs-137	pCi/L	600000	1050											
10198-40-0	Co-60	pCi/L	1000000	3760											
13966-00-2	K-40	pCi/L	1930000	2900											
13966-02-4	Be-7	pCi/L													
13966-29-5	U-234	pCi/L	400000	202											
13966-31-9	Mn-54	pCi/L													
13966-32-0	Na-22	pCi/L	25.3	3.56											
13967-48-1	Ruthenium-106, Dissolved	pCi/L													
13967-70-9	Cs-134	pCi/L	326000	518											
13968-55-3	U-233/234	pCi/L	400000	200	4	4	5.17	5.17	5.17	0				1.2925E-05	0.02585
13981-50-5	Co-57	pCi/L													
13982-63-3	Ra-226	pCi/L	8000	10.2											
13982-70-2	Uranium-236, Dissolved	pCi/L													
14234-35-6	Sb-125	pCi/L	6970000	367000											
14255-04-0	Pb-210	pCi/L	292000	601											
14269-63-7	Th-230	pCi/L	452000	2570											
14274-82-9	Th-228	pCi/L	63300	374											
14331-83-0	Ac-228	pCi/L													
14391-16-3	Eu-155	pCi/L	30000000	264000											
14391-76-5	Silver-110m, Dissolved	pCi/L													
14683-23-9	Eu-152	pCi/L	2550000	25500											
14733-03-0	Bi-214	pCi/L													
14913-49-6	Bi-212	pCi/L													
14913-50-9	Thallium-208	pCi/L													
15065-10-8	Th-234	pCi/L													
15067-28-4	Pb-214	pCi/L													
15092-94-1	Pb-212	pCi/L													
15117-96-1	U-235	pCi/L	400000	217	4	4	0.6	0.6	0.6	0				0.0000015	0.00276498
15262-20-1	Ra-228	pCi/L	7000	8.49											
15585-10-1	Eu-154	pCi/L	2000000	21600											
7440-29-1	Th-232	pCi/L	50000	304											
7440-61-1	U-238	pCi/L	400000	223	4	4	5.67	5.67	5.67	0				1.4175E-05	0.02542601
86954-36-1	Am-241	pCi/L	200000	438											

Table E-7
Data Usability Results for Radionuclides in Shallow Groundwater

CAS Number	Analyte	Units	PRG WT	PRG WA	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG WT	Samples Exceeding PRG WA	Minimum Detection Limit > PRG	Maximum Result/ PRG WT	Maximum Result/ PRG WA
UKN093	Gross alpha, Decanted	pCi/L													
UKN094	Gross alpha, Dissolved	pCi/L													
UKN095	Gross alpha, Total	pCi/L													
UKN097	Gross beta, Decanted	pCi/L													
UKN098	Gross beta, Dissolved	pCi/L													
UKN099	Gross beta, Total	pCi/L													
Exposure Unit 10															
10028-17-8	Tritium (H-3)	pCi/L	2E+08	4.99E+09	14	14	-60	500	126.30143	204.191007				0.0000025	1.002E-07
10045-97-3	Cs-137	pCi/L	600000	1050	1										
10198-40-0	Co-60	pCi/L	1000000	3760											
13966-00-2	K-40	pCi/L	1930000	2900											
13966-02-4	Be-7	pCi/L													
13966-29-5	U-234	pCi/L	400000	202											
13966-31-9	Mn-54	pCi/L													
13966-32-0	Na-22	pCi/L	25.3	3.56											
13967-48-1	Ruthenium-106, Dissolved	pCi/L													
13967-70-9	Cs-134	pCi/L	326000	518											
13968-55-3	U-233/234	pCi/L	400000	200											
13981-50-5	Co-57	pCi/L													
13982-63-3	Ra-226	pCi/L	8000	10.2	1	1	0.227	0.227	0.227					2.8375E-05	0.0222549
13982-70-2	Uranium-236, Dissolved	pCi/L													
14234-35-6	Sb-125	pCi/L	6970000	367000											
14255-04-0	Pb-210	pCi/L	292000	601											
14269-63-7	Th-230	pCi/L	452000	2570											
14274-82-9	Th-228	pCi/L	63300	374											
14331-83-0	Ac-228	pCi/L													
14391-16-3	Eu-155	pCi/L	30000000	264000											
14391-76-5	Silver-110m, Dissolved	pCi/L													
14683-23-9	Eu-152	pCi/L	2550000	25500											
14733-03-0	Bi-214	pCi/L													
14913-49-6	Bi-212	pCi/L													
14913-50-9	Thallium-208	pCi/L													
15065-10-8	Th-234	pCi/L													
15067-28-4	Pb-214	pCi/L													
15092-94-1	Pb-212	pCi/L													
15117-96-1	U-235	pCi/L	400000	217											
15262-20-1	Ra-228	pCi/L	7000	8.49	1	1	0.167	0.167	0.167					2.3857E-05	0.0196702
15585-10-1	Eu-154	pCi/L	2000000	21600											
7440-29-1	Th-232	pCi/L	50000	304											
7440-61-1	U-238	pCi/L	400000	223											
86954-36-1	Am-241	pCi/L	200000	438											
UKN093	Gross alpha, Decanted	pCi/L													
UKN094	Gross alpha, Dissolved	pCi/L			5	5	3	11.6	6.668	4.04550615	5	5			
UKN095	Gross alpha, Total	pCi/L													
UKN097	Gross beta, Decanted	pCi/L													
UKN098	Gross beta, Dissolved	pCi/L			5	5	1.4	8.93	3.846	2.92217043	5	5			
UKN099	Gross beta, Total	pCi/L													
Exposure Unit 11															

Table E-7
Data Usability Results for Radionuclides in Shallow Groundwater

CAS Number	Analyte	Units	PRG WT	PRG WA	Samples	Detects	Minimum Result	Maximum Result	Average Result	Standard Deviation	Samples Exceeding PRG WT	Samples Exceeding PRG WA	Minimum Detection Limit > PRG	Maximum Result/ PRG WT	Maximum Result/ PRG WA
10028-17-8	Tritium (H-3)	pCi/L	2E+08	4.99E+09	114	114	-200	1099	114.4964	224.967071				5.495E-06	2.2024E-07
10045-97-3	Cs-137	pCi/L	600000	1050	51	46	-6.3	31.3	3.6335217	7.44900431				5.2167E-05	0.02980952
10198-40-0	Co-60	pCi/L	1000000	3760	44	43	-2.3	32.6	4.8198372	7.68772028				0.0000326	0.00867021
13966-00-2	K-40	pCi/L	1930000	2900	25	25	-21.8	444	86.636	125.316905				0.00023005	0.15310345
13966-02-4	Be-7	pCi/L			1	1	16.5	16.5	16.5		1	1			
13966-29-5	U-234	pCi/L	400000	202	1	1	12.7	12.7	12.7					0.00003175	0.06287129
13966-31-9	Mn-54	pCi/L			10	10	-0.031	2.28	1.1367	0.57014833	10	10			
13966-32-0	Na-22	pCi/L	25.3	3.56	9	9	0.14	2.18	1.2327778	0.53913769				0.08616601	0.61235955
13967-48-1	Ruthenium-106, Dissolved	pCi/L			1	1	7.91	7.91	7.91		1	1			
13967-70-9	Cs-134	pCi/L	326000	518	42	42	-5.3	32.3	5.1119048	8.38868089				9.908E-05	0.06235521
13968-55-3	U-233/234	pCi/L	400000	200	42	42	1.8	36.6	12.52381	7.02001631				0.0000915	0.183
13981-50-5	Co-57	pCi/L			43	42	-5.8	16.5	2.8939524	4.21597335	42	42			
13982-63-3	Ra-226	pCi/L	8000	10.2	23	23	-110	316	57.608826	102.846906		11		0.0395	30.9803922
13982-70-2	Uranium-236, Dissolved	pCi/L			1	1	2.1	2.1	2.1		1	1			
14234-35-6	Sb-125	pCi/L	6970000	367000	1	1	2.35	2.35	2.35					3.3716E-07	6.4033E-06
14255-04-0	Pb-210	pCi/L	292000	601	13	13	5	2380	503.47692	669.638078		3		0.00815068	3.96006656
14269-63-7	Th-230	pCi/L	452000	2570	30	27	-0.038	1.28	0.1353885	0.27540858				2.8319E-06	0.00049805
14274-82-9	Th-228	pCi/L	63300	374	30	28	-0.07	0.6	0.0527857	0.14449615				9.4787E-06	0.00160428
14331-83-0	Ac-228	pCi/L			15	15	-19	112	25.002667	33.3671991	15	15			
14391-16-3	Eu-155	pCi/L	30000000	264000	1	1	3.2	3.2	3.2					1.0667E-07	1.2121E-05
14391-76-5	Silver-110m, Dissolved	pCi/L			1	1	1.9	1.9	1.9		1	1			
14683-23-9	Eu-152	pCi/L	2550000	25500	10	10	-2.26	5.97	2.964	2.21071733				2.3412E-06	0.00023412
14733-03-0	Bi-214	pCi/L			15	15	3	51.5	15.832	14.6895168	15	15			
14913-49-6	Bi-212	pCi/L			13	13	2.1	183	54.938462	55.0443993	13	13			
14913-50-9	Thallium-208	pCi/L			11	10	-2.6	26.5	9.142	8.24447802	10	10			
15065-10-8	Th-234	pCi/L			16	16	5	486	134.4375	141.940574	16	16			
15067-28-4	Pb-214	pCi/L			16	16	-50	46.4	11.38375	21.2752322	16	16			
15092-94-1	Pb-212	pCi/L			17	17	-6.2	35.8	10.056471	11.5219681	17	17			
15117-96-1	U-235	pCi/L	400000	217	59	59	-4	132	9.029661	22.6946581				0.00033	0.60829493
15262-20-1	Ra-228	pCi/L	7000	8.49	9	9	0.054	1	0.4596667	0.33981061				0.00014286	0.11778563
15585-10-1	Eu-154	pCi/L	2000000	21600	10	10	1	6.31	3.689	1.34076636				3.155E-06	0.00029213
7440-29-1	Th-232	pCi/L	50000	304	30	22	-0.011	0.6	0.0487045	0.13085039				0.000012	0.00197368
7440-61-1	U-238	pCi/L	400000	223	42	42	3.6	41.9	12.221429	6.93973099				0.00010475	0.18789238
86954-36-1	Am-241	pCi/L	200000	438	1	1	16.2	16.2	16.2					0.000081	0.0369863
UKN093	Gross alpha, Decanted	pCi/L													
UKN094	Gross alpha, Dissolved	pCi/L			59	59	-0.194	78	22.532983	15.1864738	59	59			
UKN095	Gross alpha, Total	pCi/L			2	2	20	27.6	23.8	5.37401154	2	2			
UKN097	Gross beta, Decanted	pCi/L													
UKN098	Gross beta, Dissolved	pCi/L			58	58	-6.78	50	12.471034	9.27767622	58	58			
UKN099	Gross beta, Total	pCi/L			2	2	11	33	22	15.5563492	2	2			

CAS = Chemical Abstract Service
WT = Water, terrestrial; WA = Water, aquatic
PRG = preliminary remediation goal
pCi /L = picocurie per liter

Appendix F

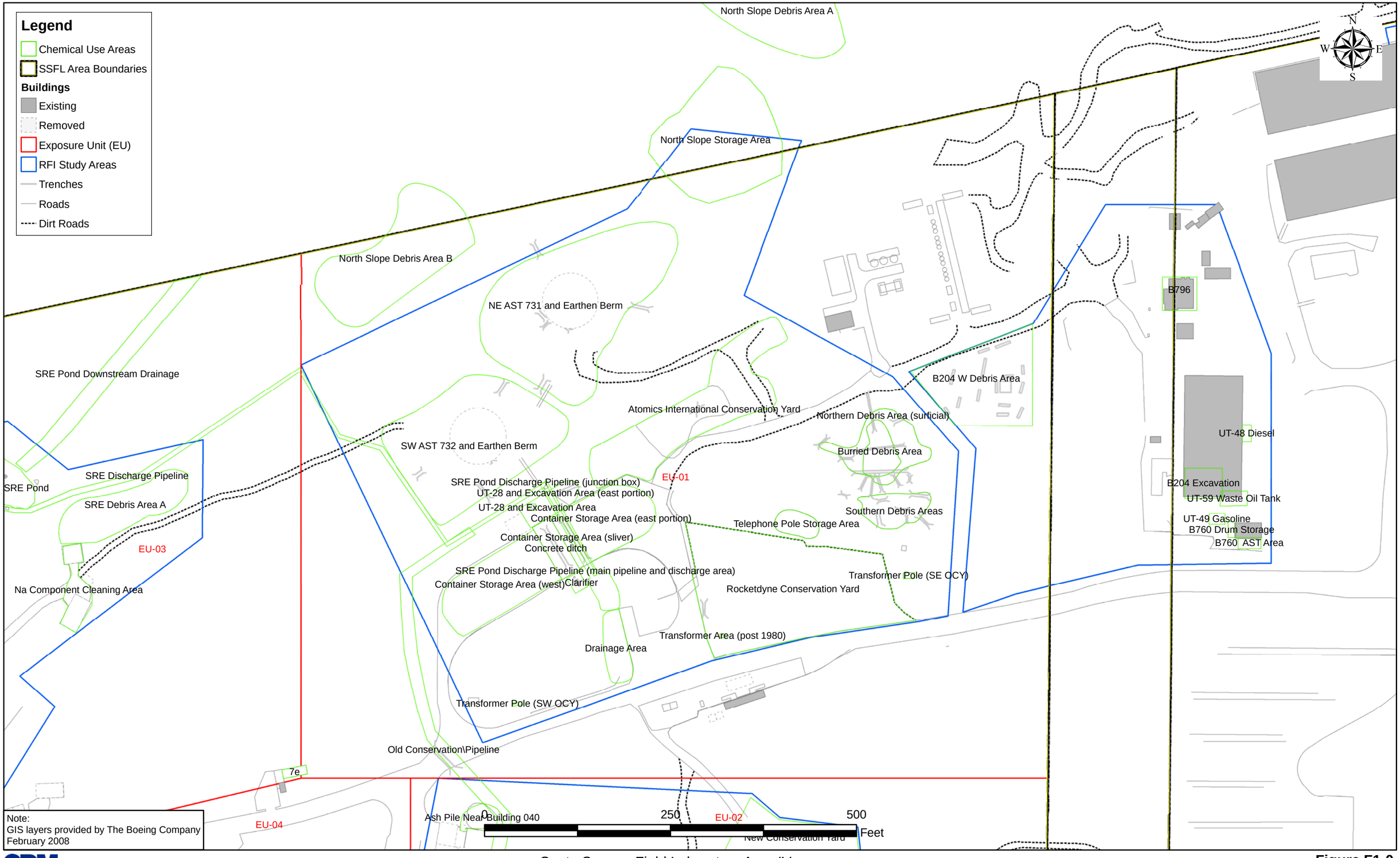
Chemical and Radionuclide Contaminants of Interest Distribution Maps

Appendix F
Chemical and Radionuclide Contaminants of Interest Distribution Maps

Appendix F contains a series of maps indicating locations where samples have been collected for analysis of chemical and radiological chemicals of interest (COIs). In the case of chemicals, the color of the "sample dot" indicates if the concentrations of COIs exceed the Derived Concentration Guideline Level (DCGL). These maps are used as the basis for evaluating where additional data are needed for characterizing Chemical Use Areas that have not previously been characterized, delineating areas where chemicals have already been found at concentrations above DCGLs, or determining where samples should be collected in undeveloped areas within each Exposure Unit (EU) in order to fully characterize Area IV. For the radionuclide COIs, the sample dots are color coded to indicate the percentage of the DCGL that was exceeded by the sample result. These maps are used to delineate and classify the Survey Units (SUs) within each EU.

The maps are organized by EU and the first map within each "EU package of maps" indicates the Chemical Use Areas within the EU. All COIs within a chemical group are shown on two maps: one for the 0 to 2-foot depth and another for the 2 to 10-foot depth. The chemical groups include Volatile Organic Compounds (VOCs), Semi-volatile Organic Compound (SVOCs), Polychlorinated Biphenyls (PCBs), inorganic compounds (metals and cyanide) and Dioxin. A map showing the distribution of the radionuclide COIs follows the chemical distribution maps.

It is important to note that these maps represent data for particular chemicals that are included in the Database at a particular point in time and they only represent data present in the data base, subject to the review and corrections discussed in Section 3.1.3. Data for samples collected from soil that has been removed from the site (through a removal action) prior to the start of the Data Gap Analysis, are not included in the Database, and these sample locations are not shown. Only data for COIs within each chemical class are shown. Similarly, the color of the sample dot is relative to the specific screening criteria used in this EIS Data Gaps Analysis.



Note:
GIS layers provided by The Boeing Company
February 2008

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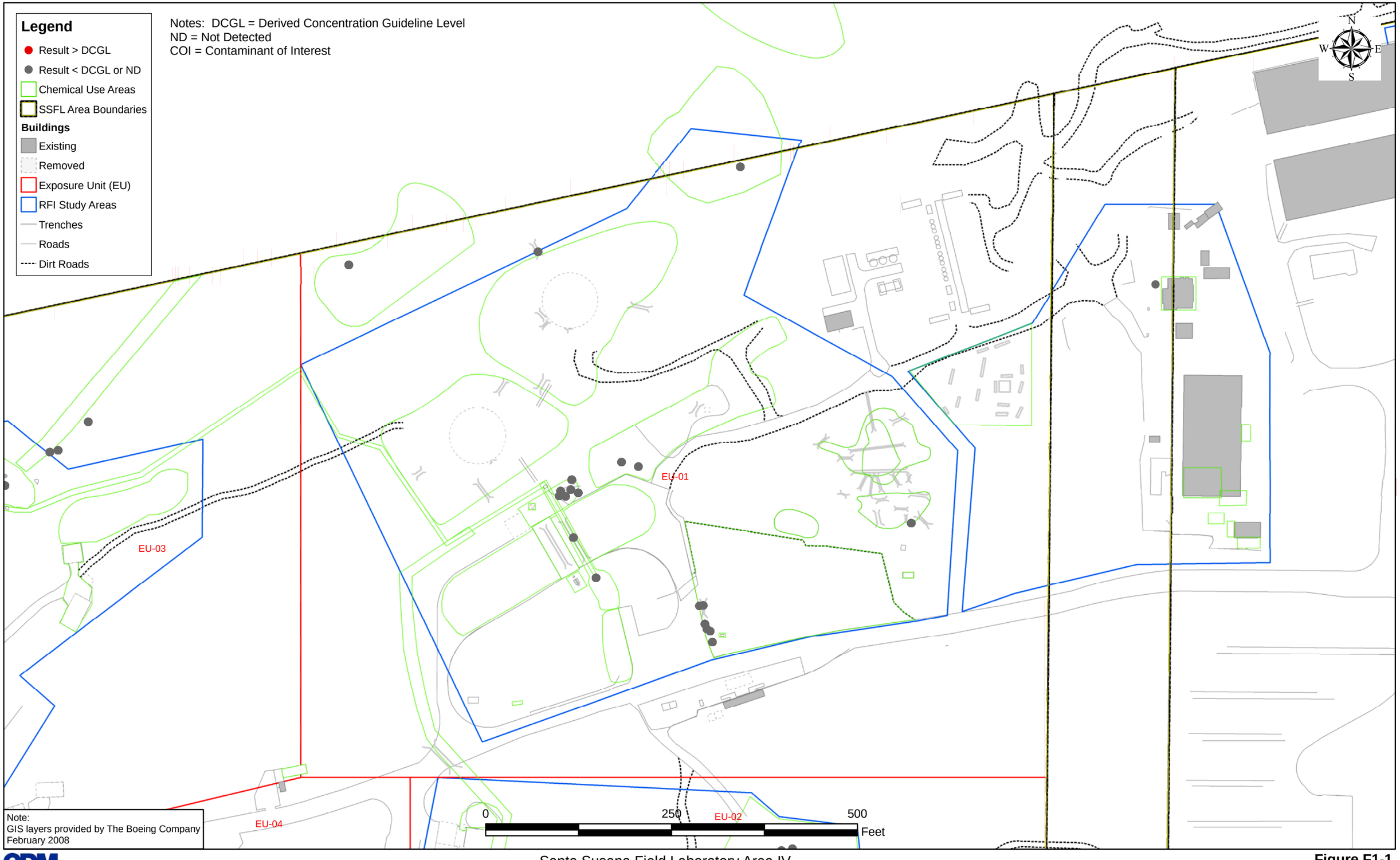
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-0
EU-01 Chemical Use Areas



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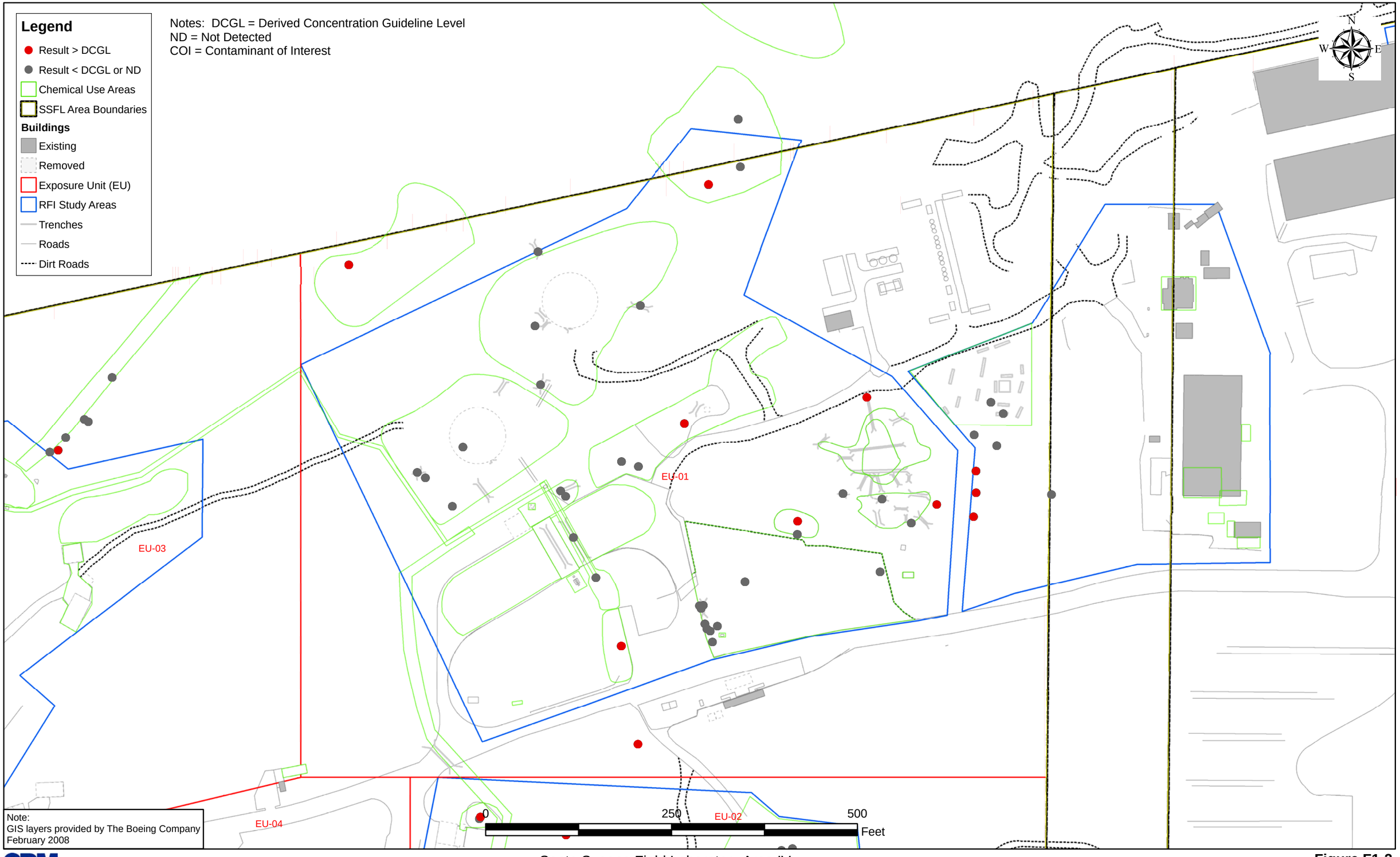
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-1
VOC COIs in Soils - EU-01
(0-2 ft bgs)



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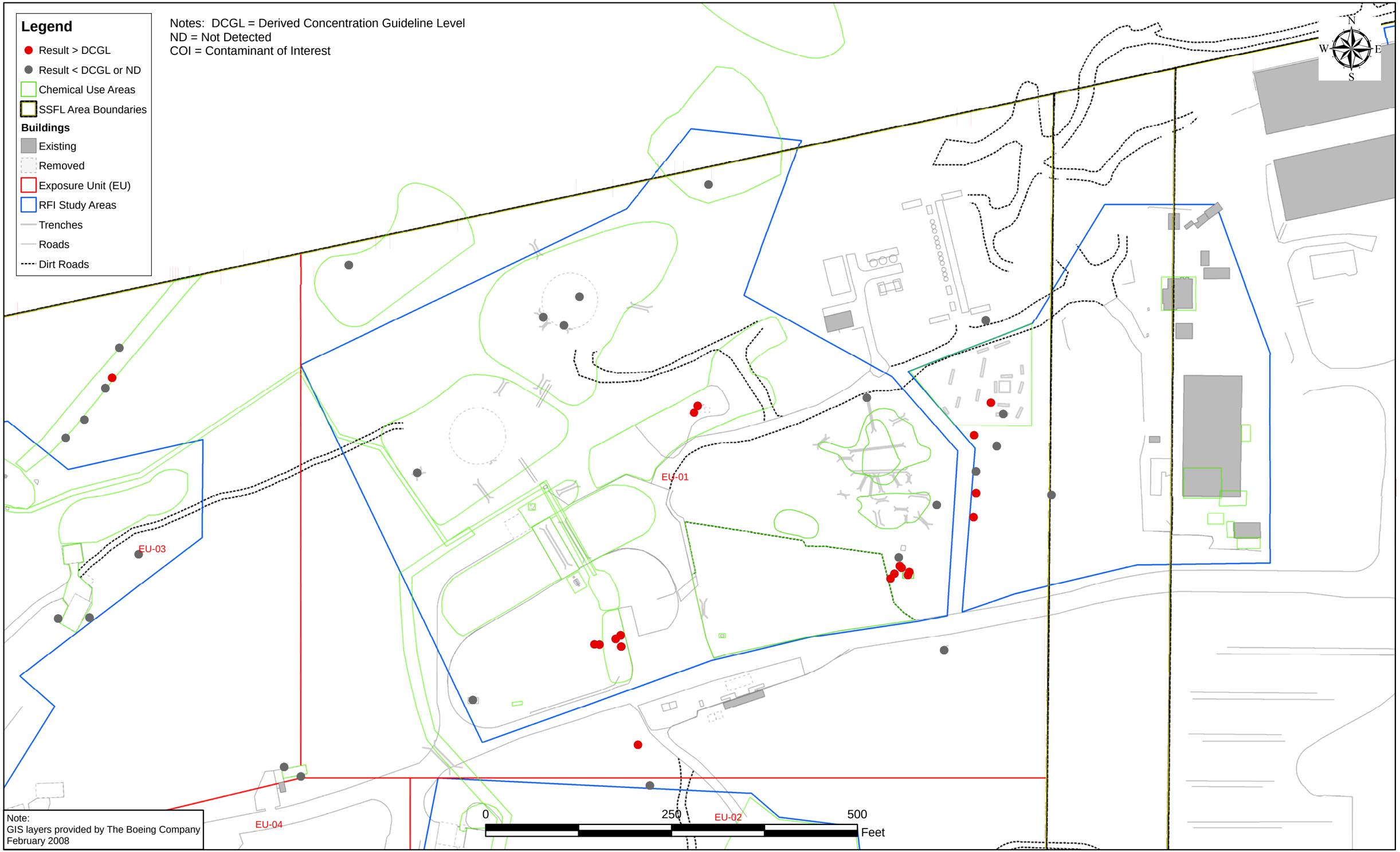
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-2
SVOC COIs in Soils - EU-01
(0-2 ft bgs)



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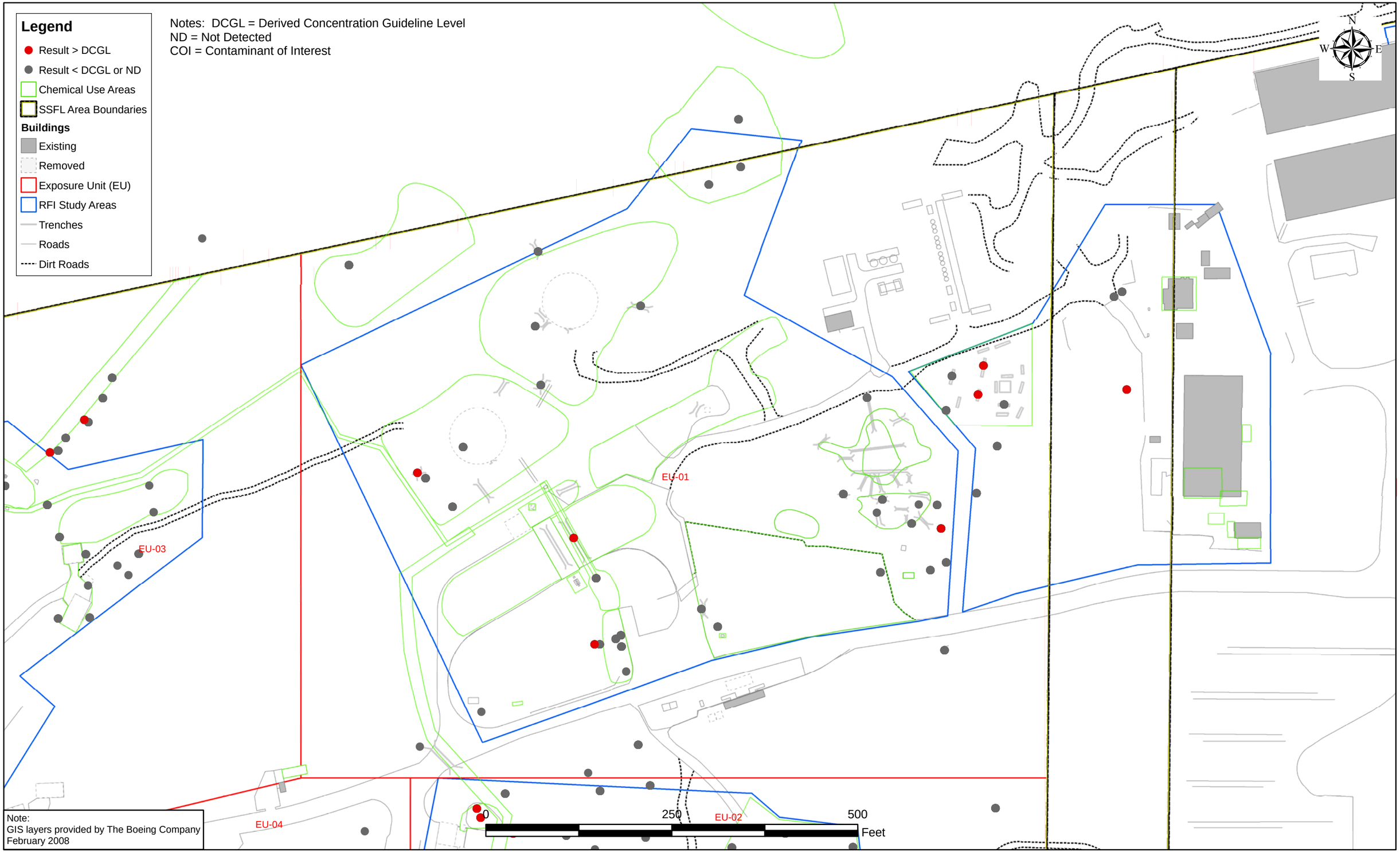
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-3
PCB COIs in Soils - EU-01
(0-2 ft bgs)



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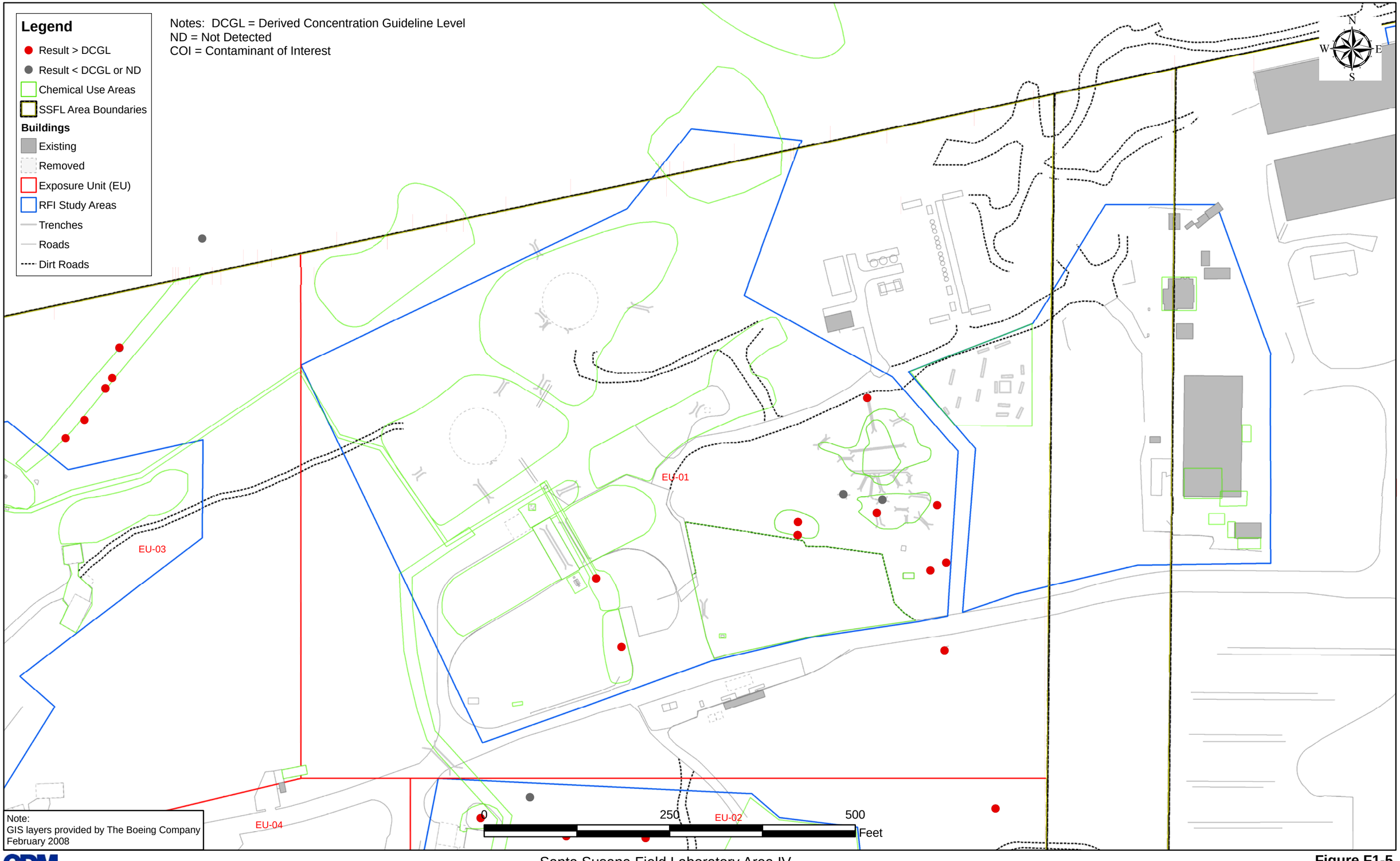
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-4
Inorganic COIs in Soils - EU-01
(0-2 ft bgs)



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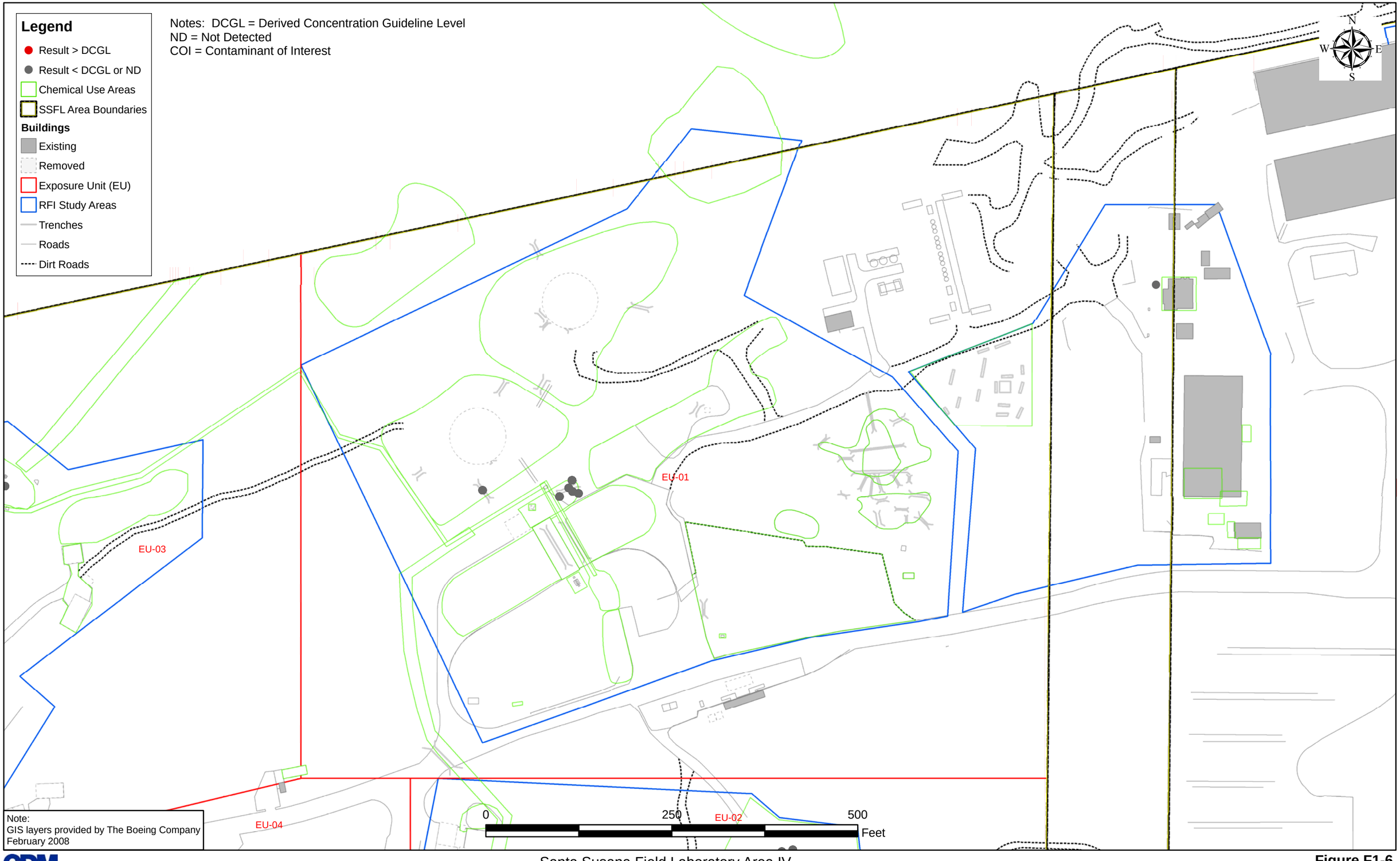
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-5
Dioxin COIs in Soils - EU-01
(0-2 ft bgs)



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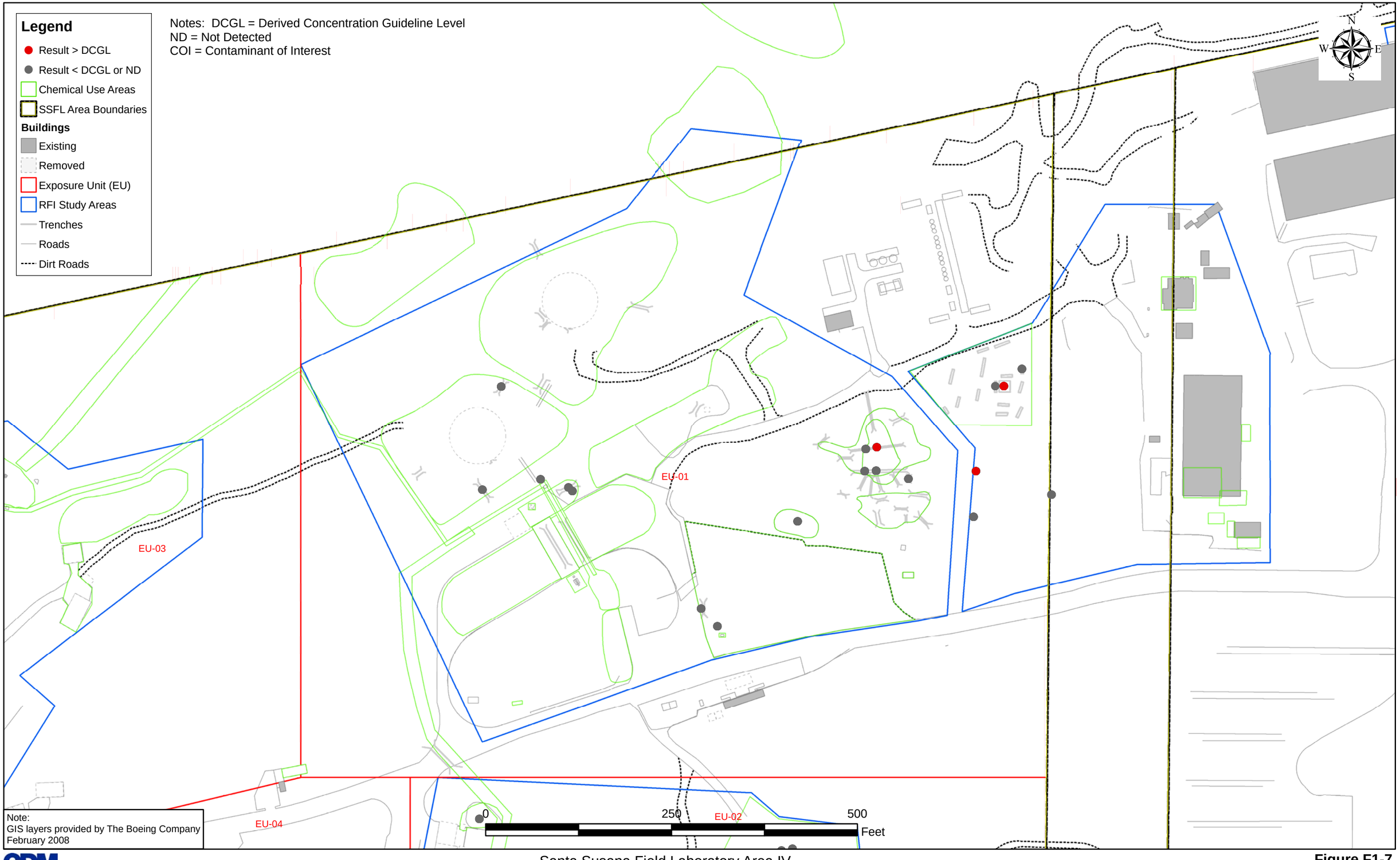
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-6
VOC COIs in Soils - EU-01
(2-10 ft bgs)



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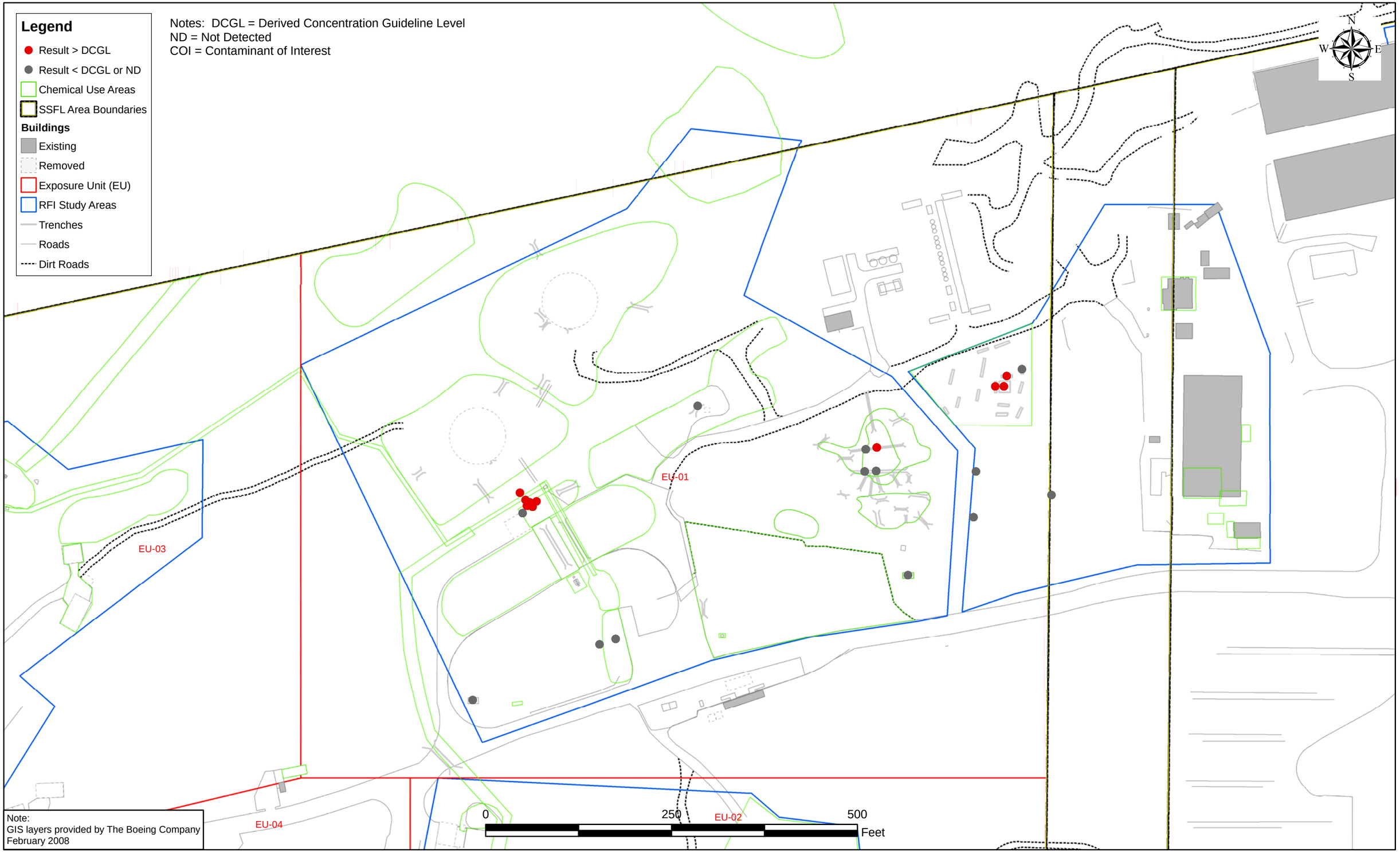
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-7
SVOC COIs in Soils - EU-01
(2-10 ft bgs)



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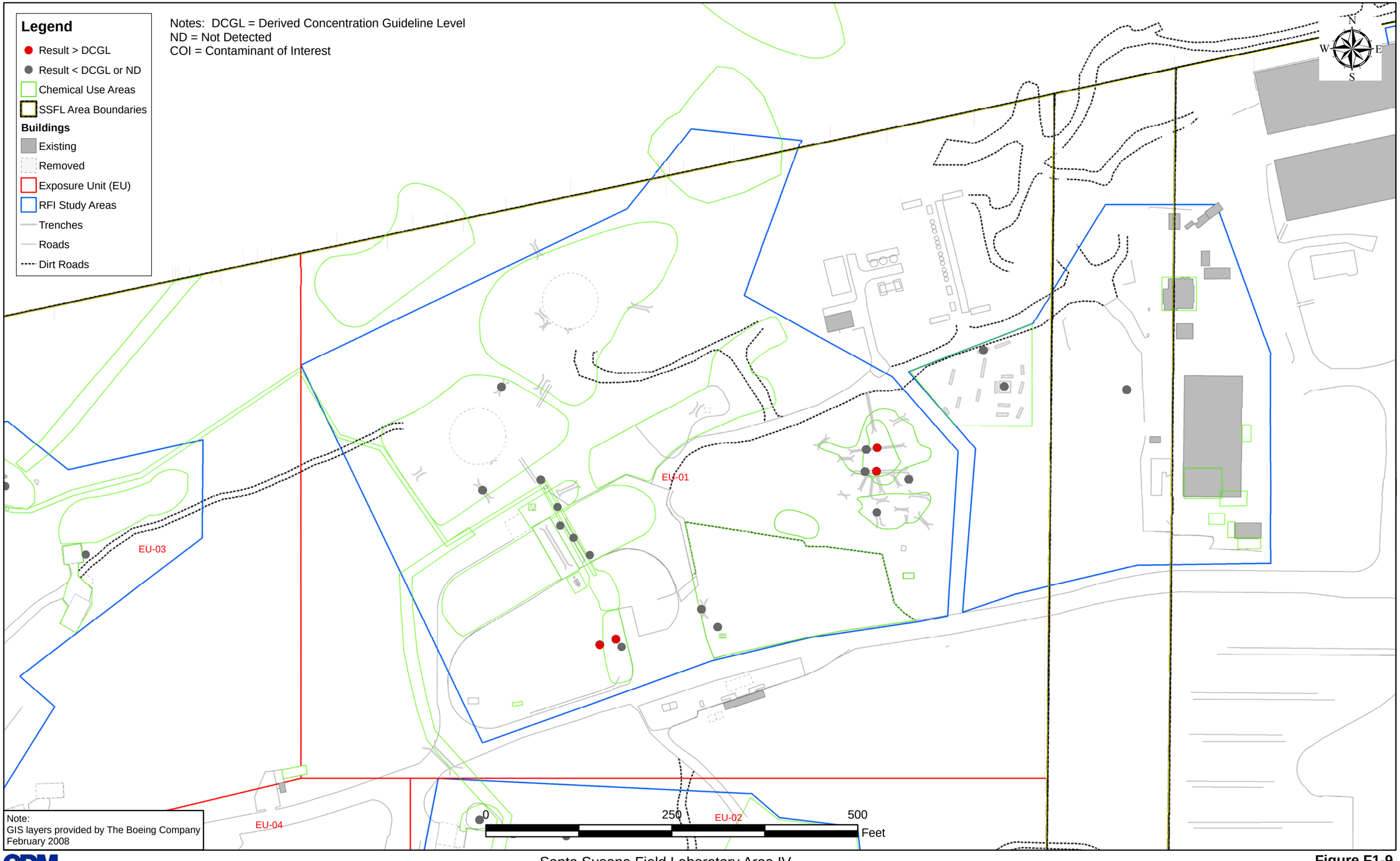
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-8
PCB COIs in Soils - EU-01
(2-10 ft bgs)



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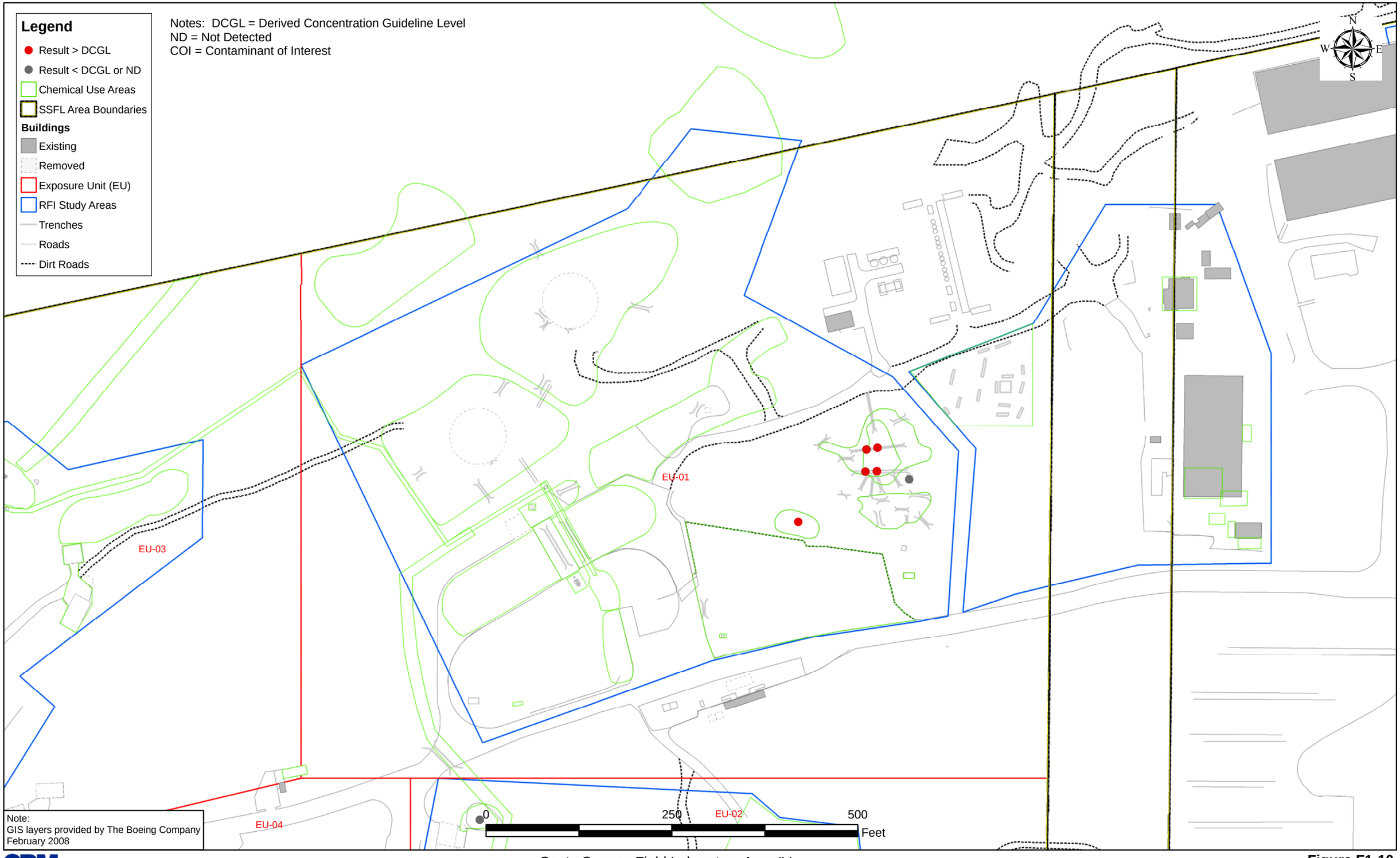
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-9
Inorganic COIs in Soils - EU-01
(2-10 ft bgs)



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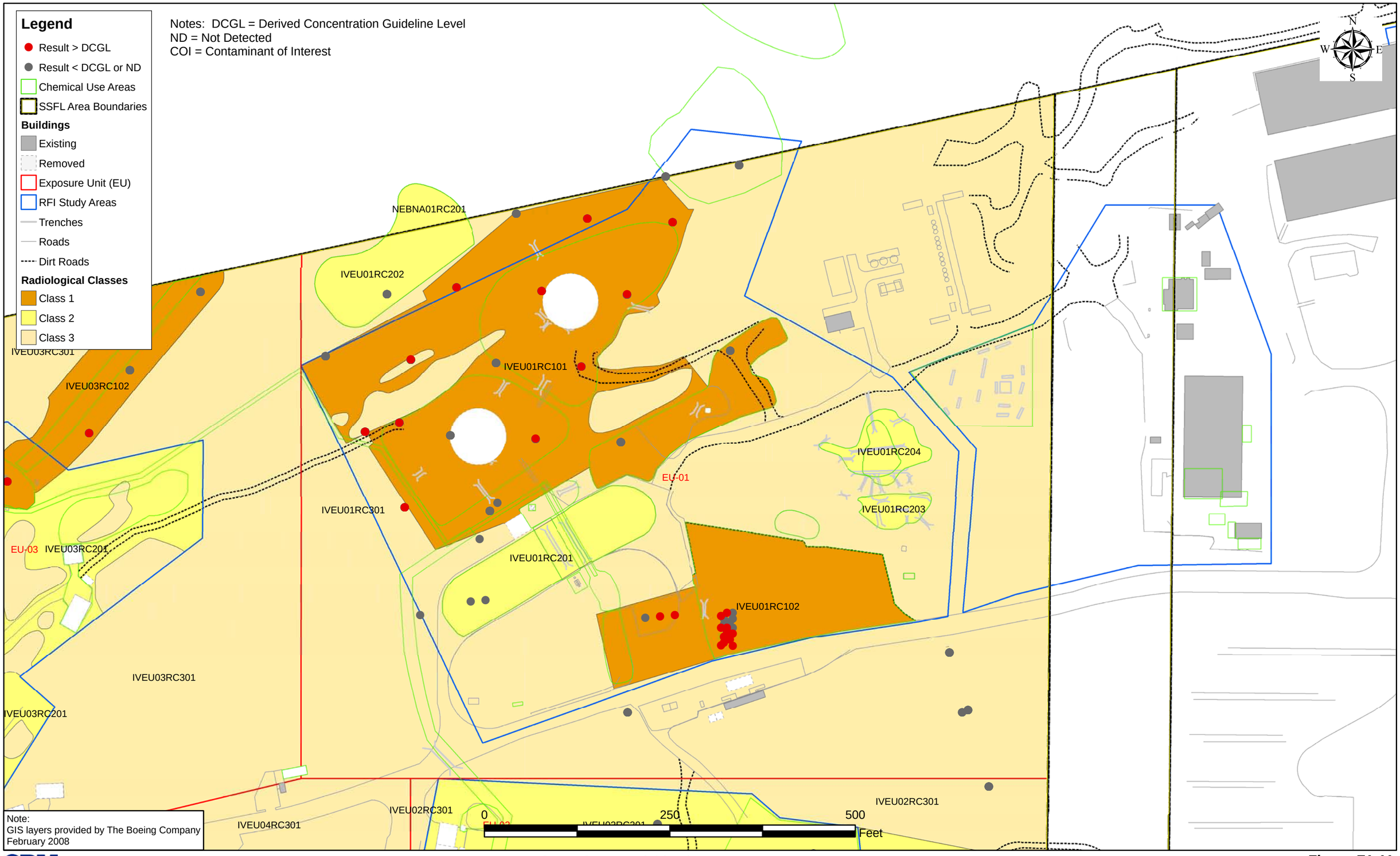
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-10
Dioxin COIs in Soils - EU-01
(2-10 ft bgs)



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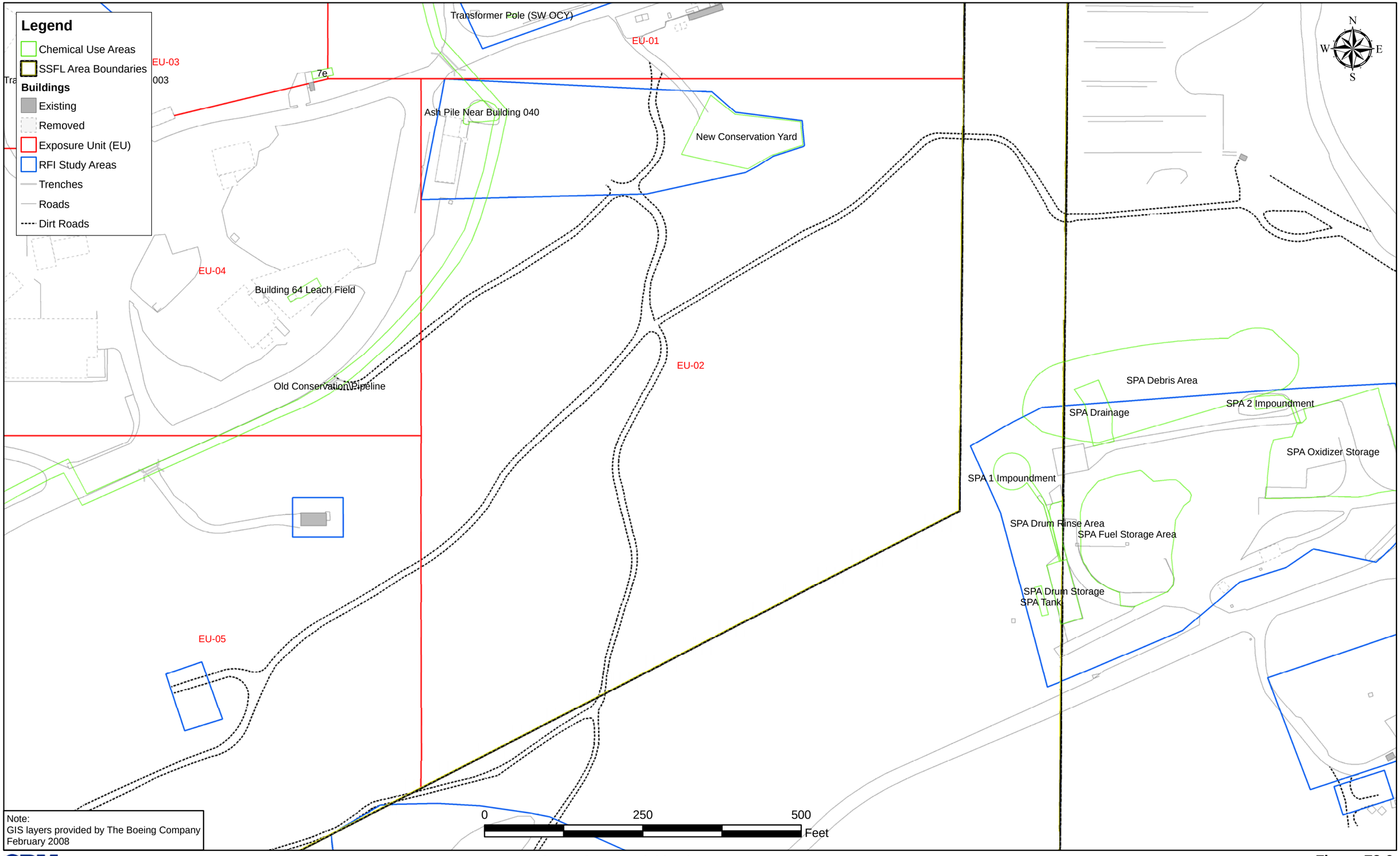
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F1-11
Radiological COIs in Soils - EU-01
(0-6 in bgs)



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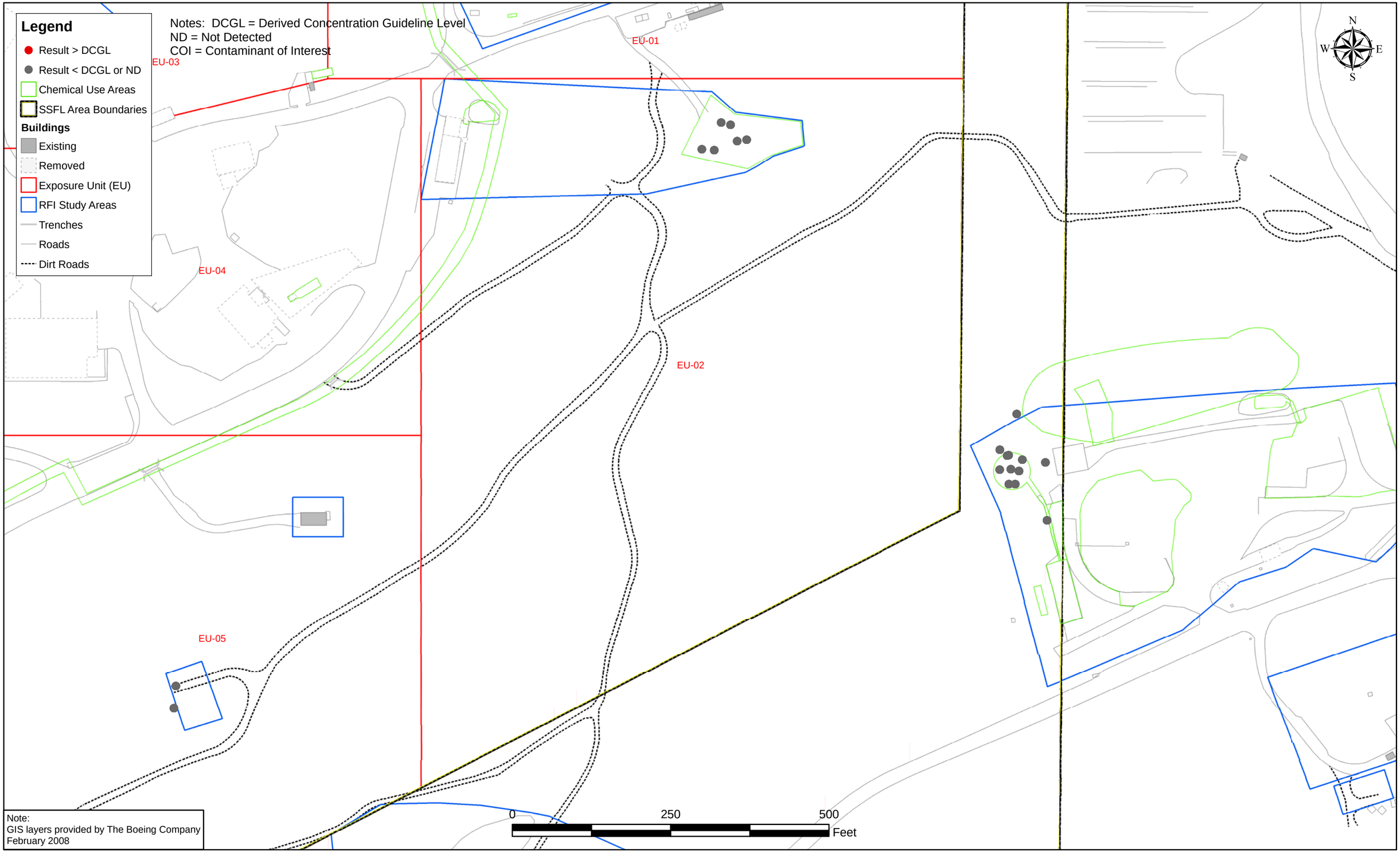
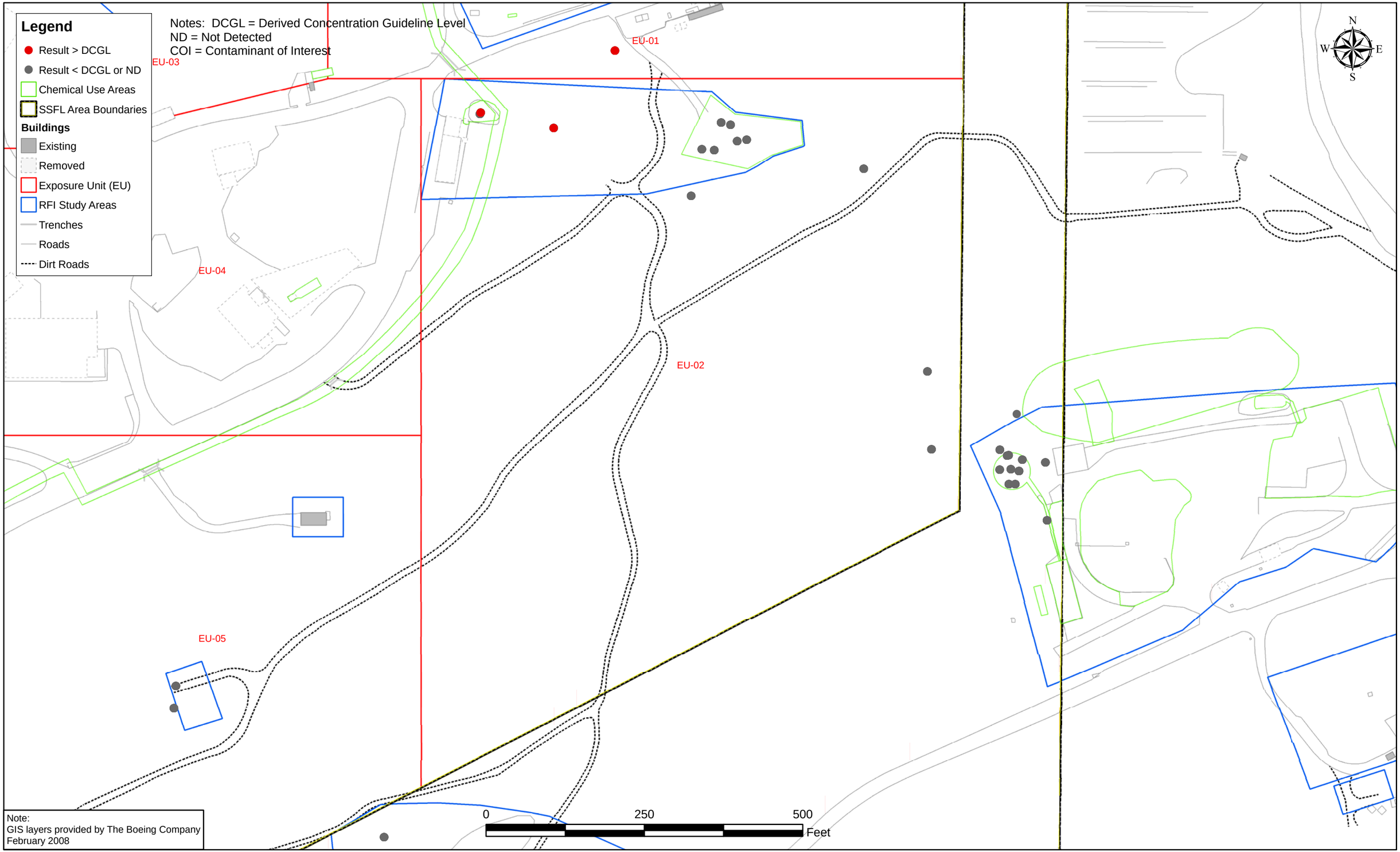
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-0
EU-02 Chemical Use Areas



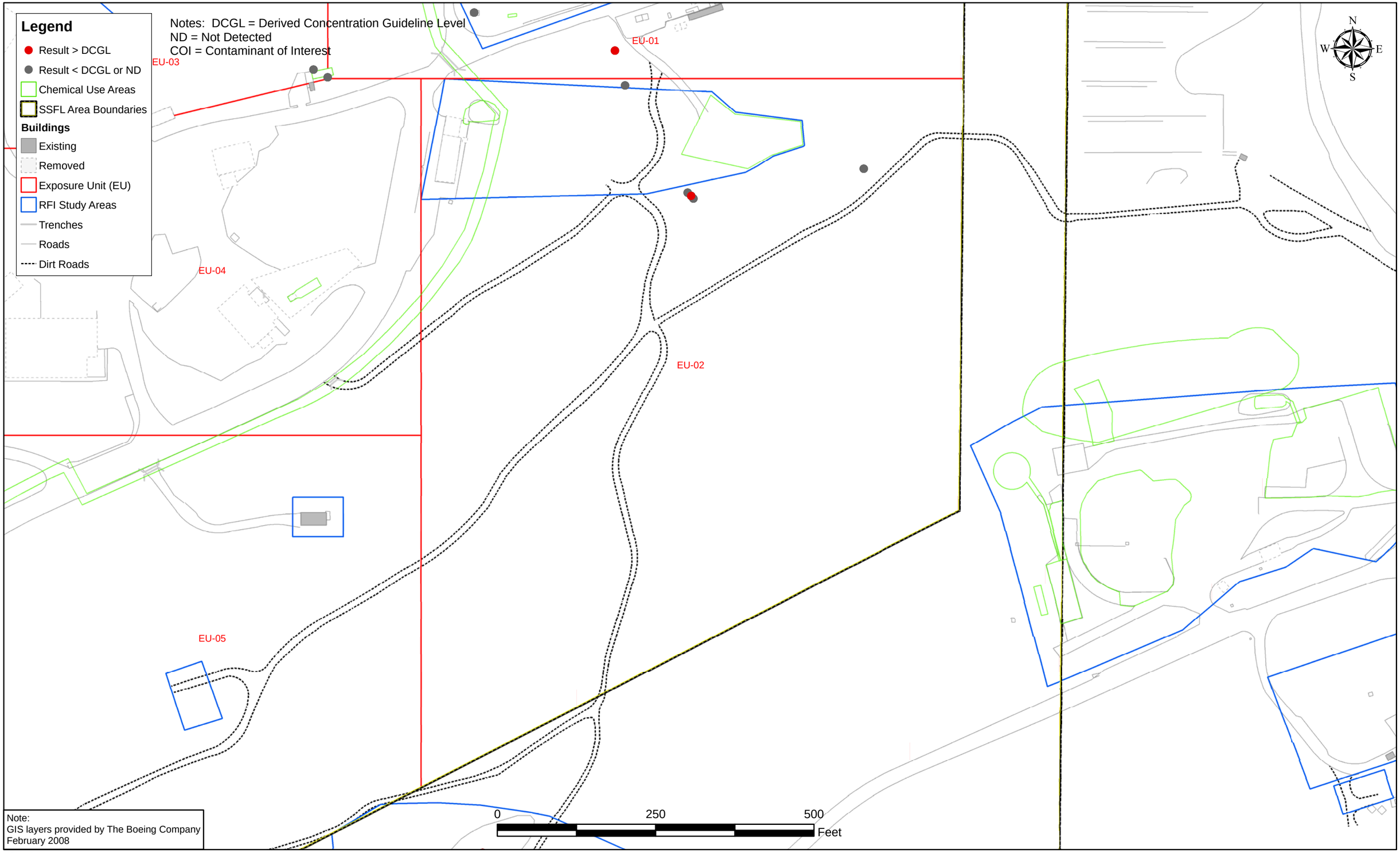
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-1
VOC COIs in Soils - EU-02
(0-2 ft bgs)



Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-2
SVOC COIs in Soils - EU-02
(0-2 ft bgs)



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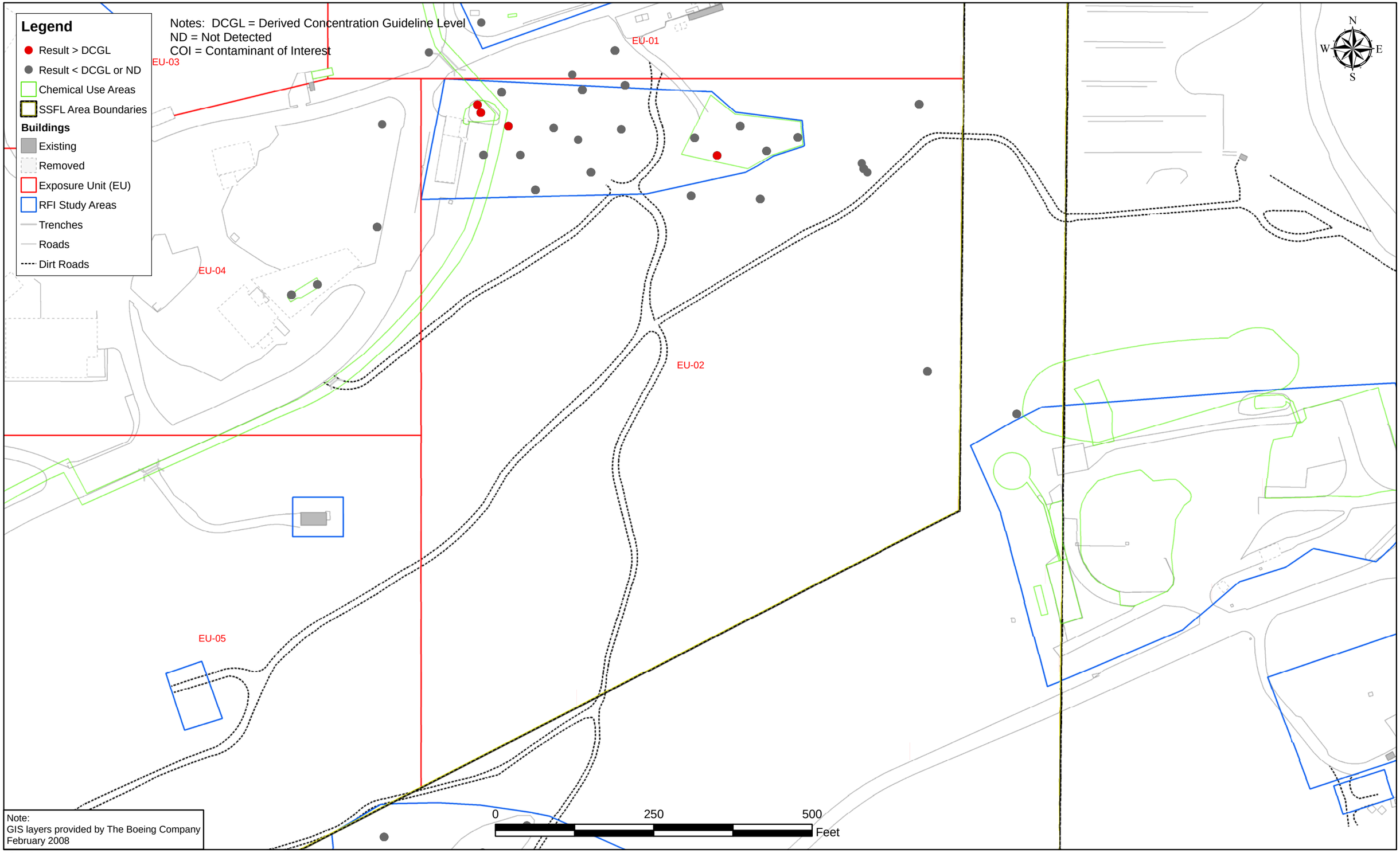
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-3
PCB COIs in Soils - EU-02
(0-2 ft bgs)



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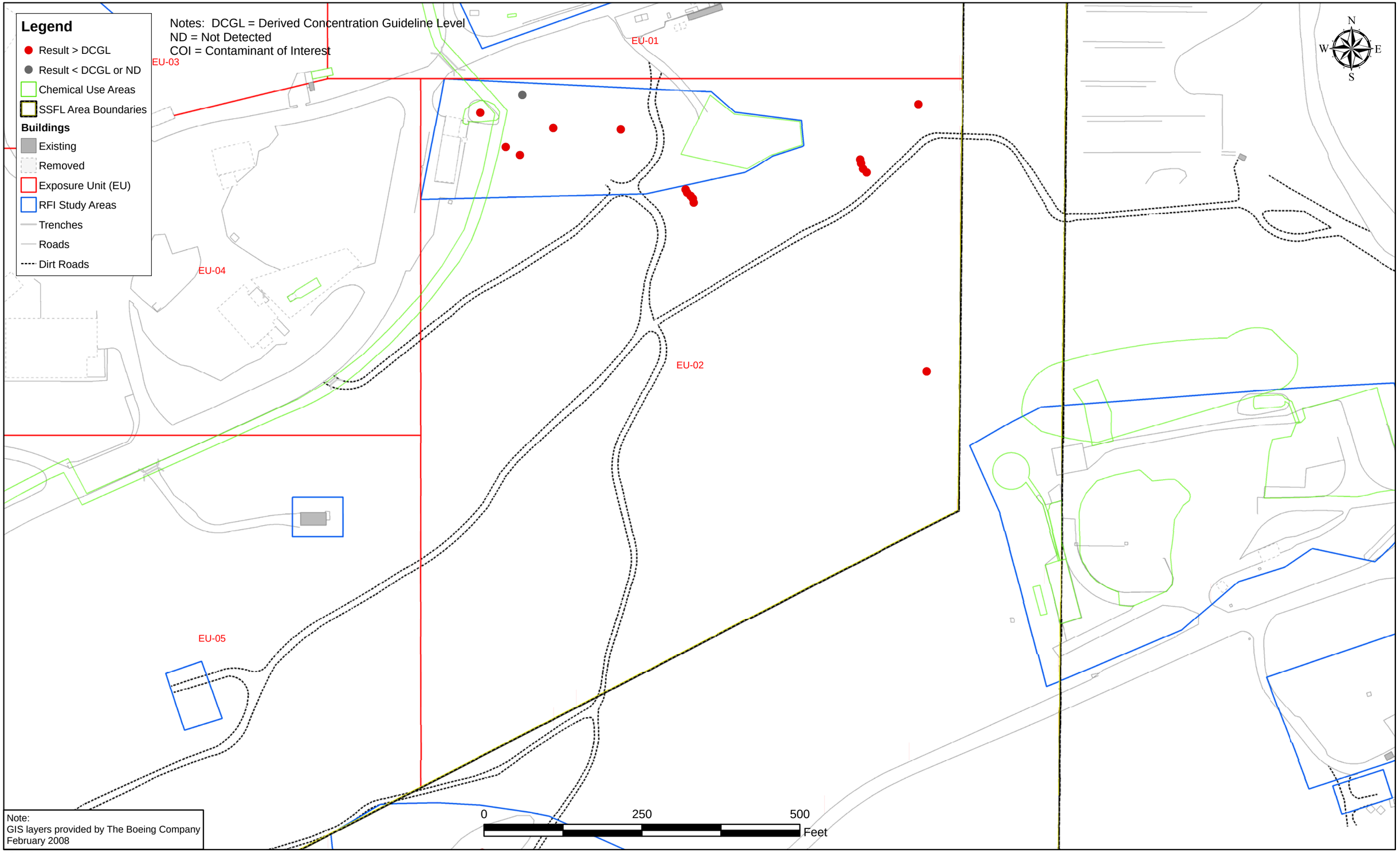
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-4
Inorganic COIs in Soils - EU-02
(0-2 ft bgs)



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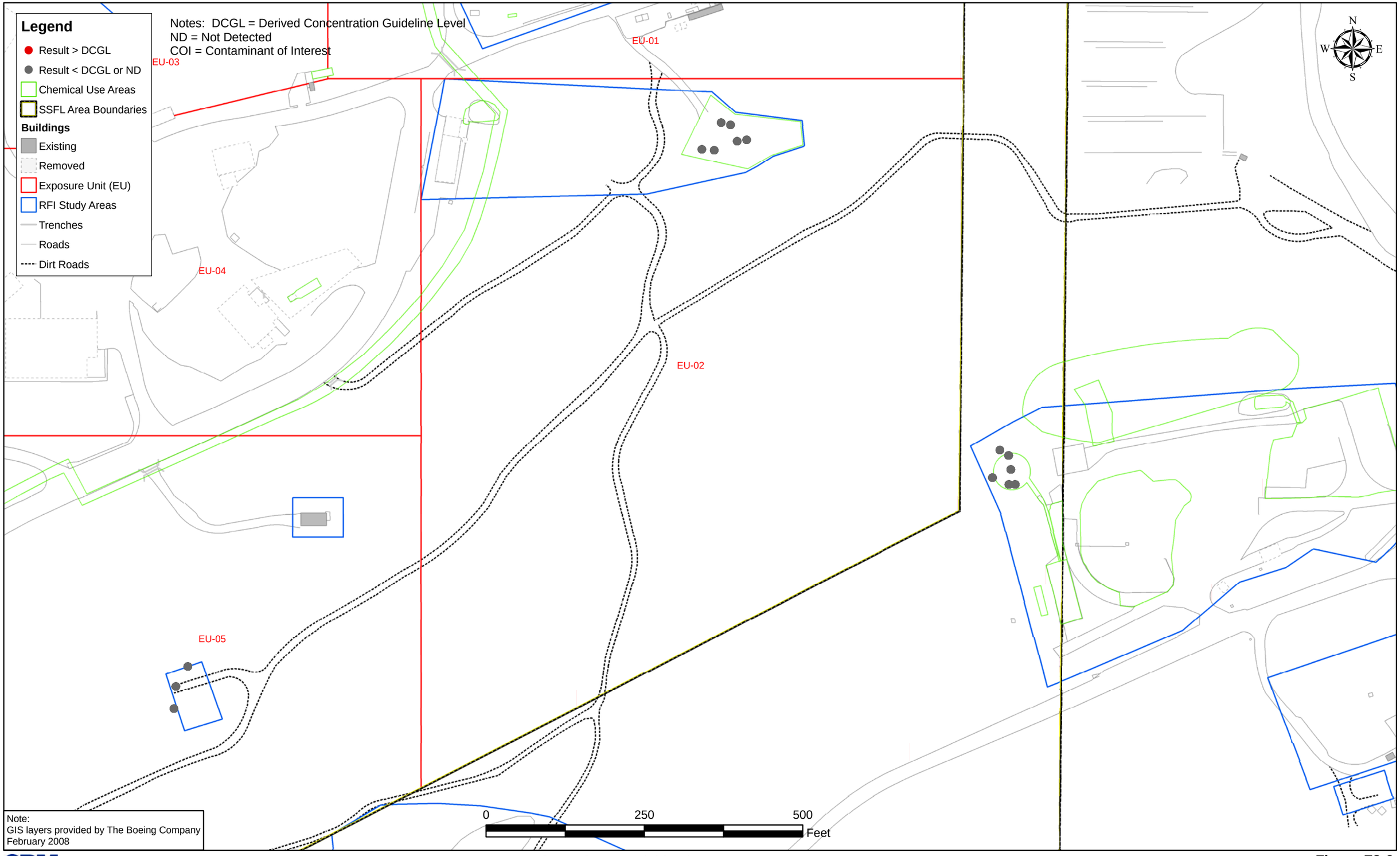
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-5
Dioxin COIs in Soils - EU-02
(0-2 ft bgs)



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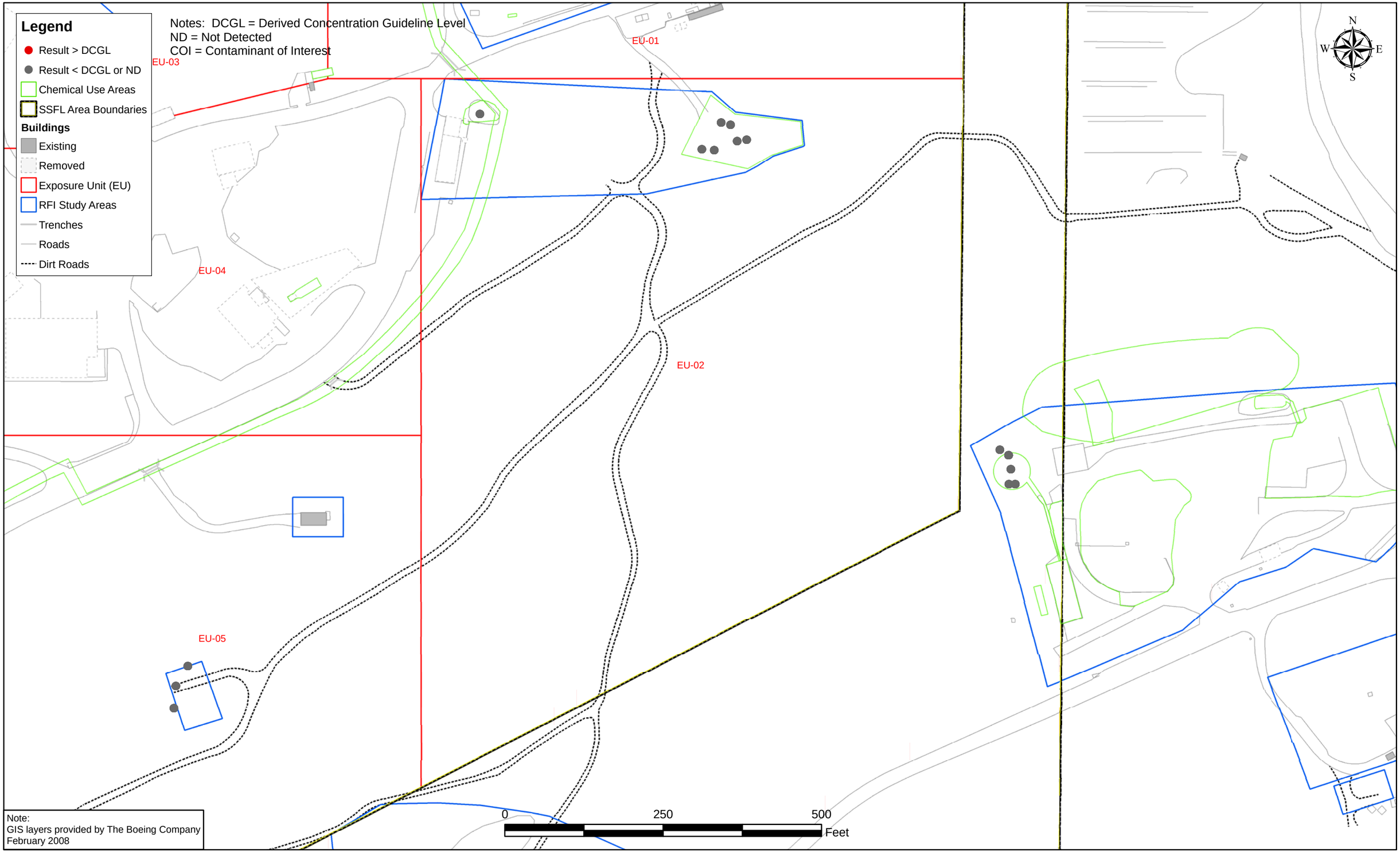
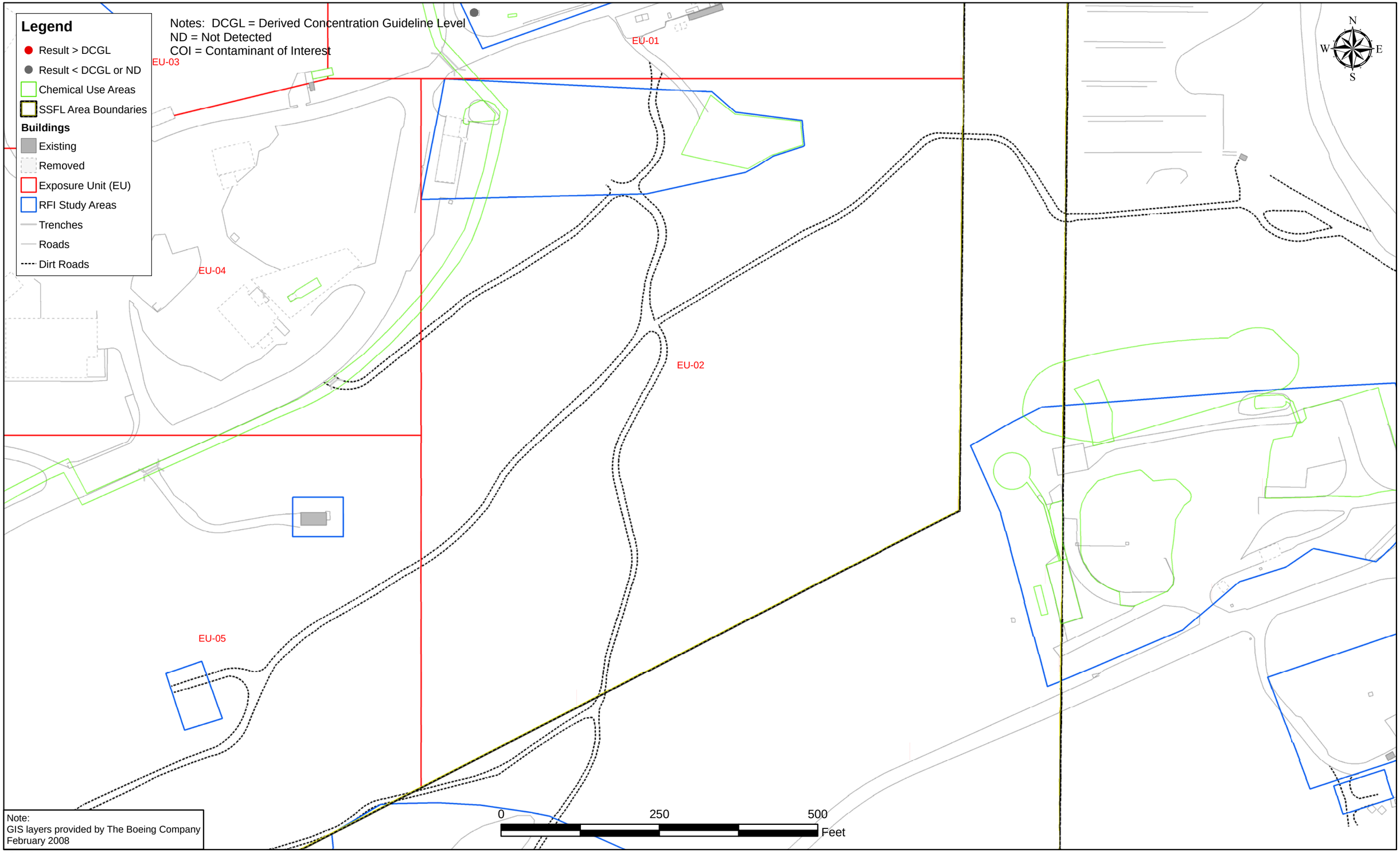
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-6
VOC COIs in Soils - EU-02
(2-10 ft bgs)



Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-7
SVOC COIs in Soils - EU-02
(2-10 ft bgs)



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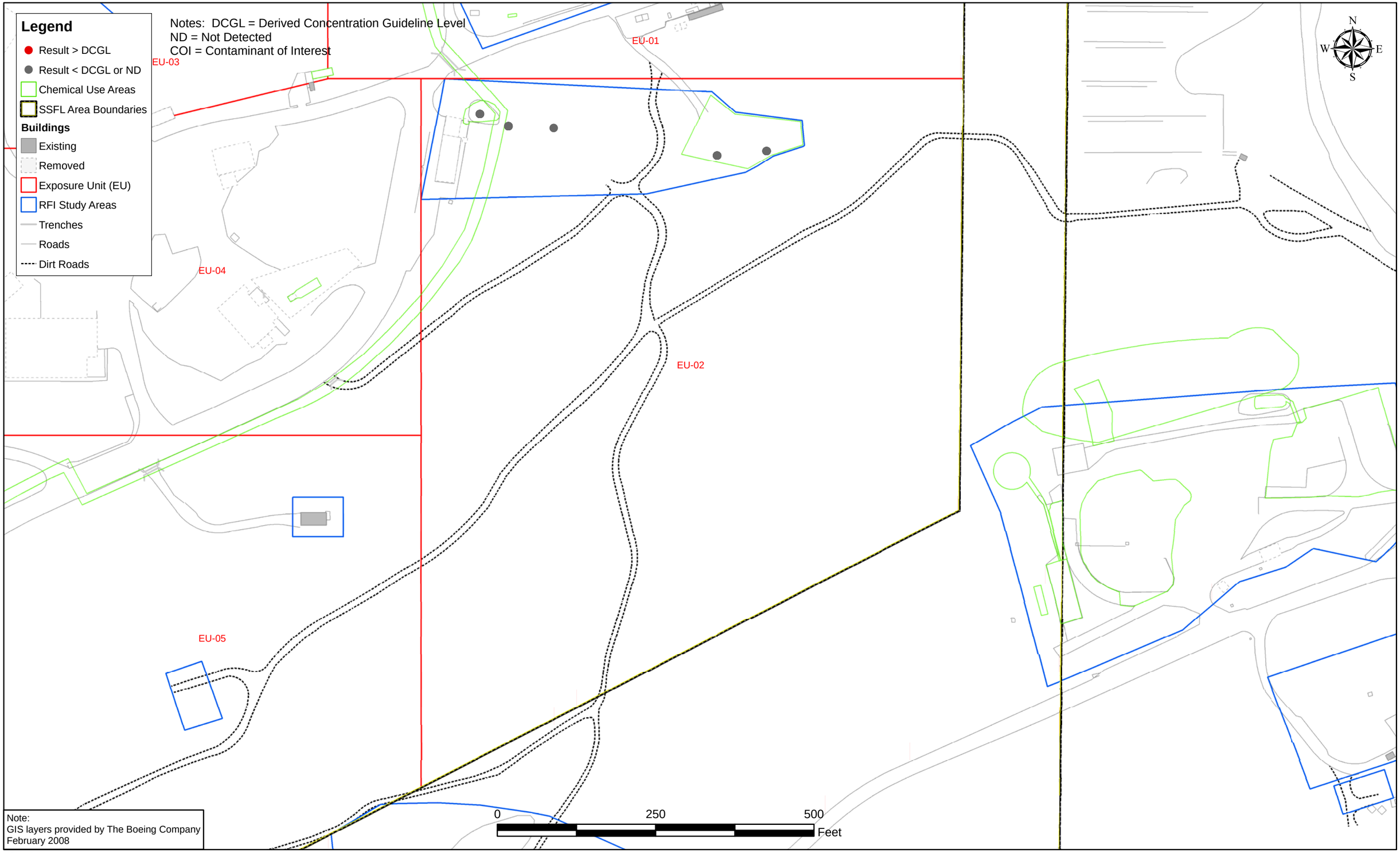
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-8
PCB COIs in Soils - EU-02
(2-10 ft bgs)



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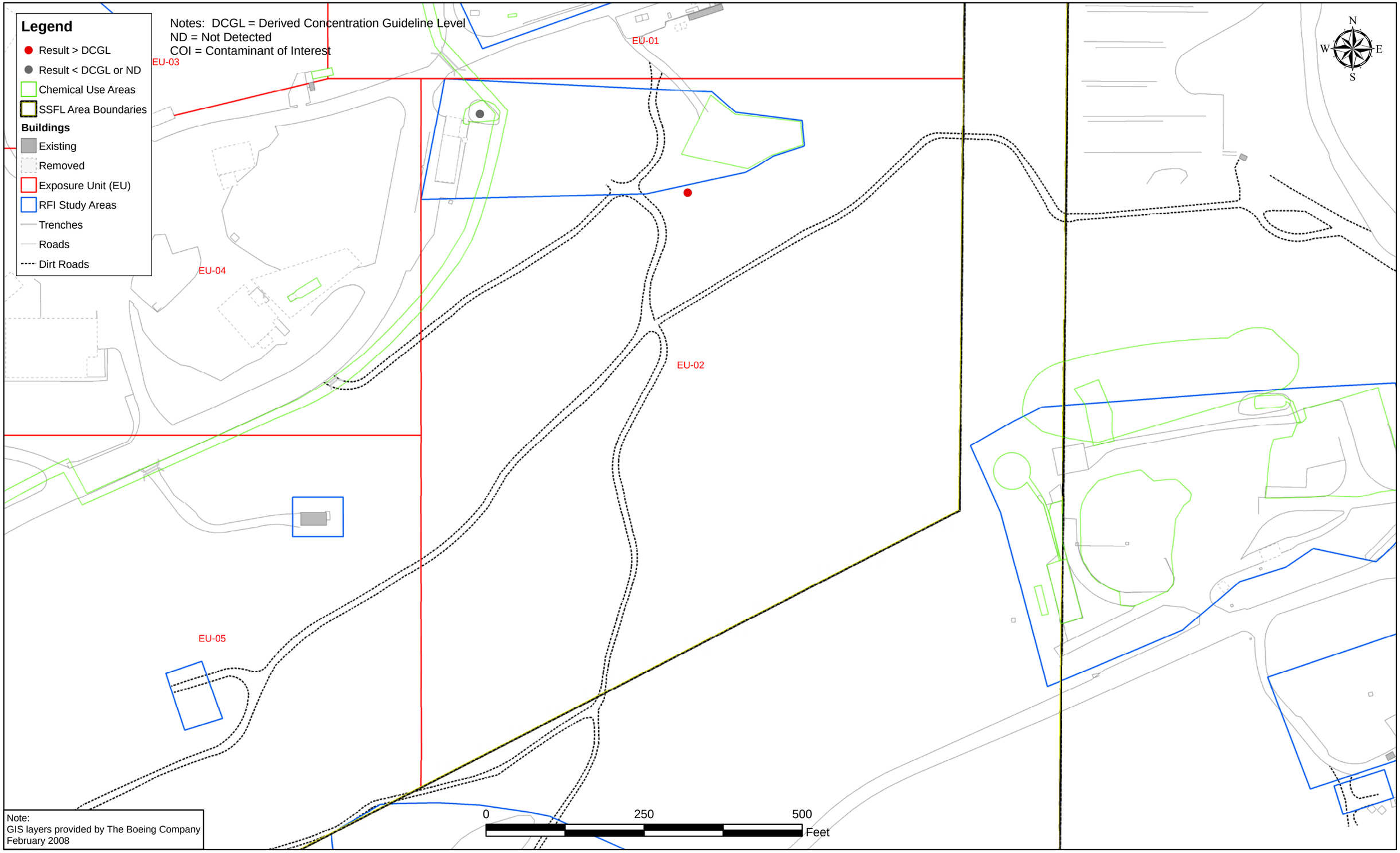
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-9
Inorganic COIs in Soils - EU-02
(2-10 ft bgs)



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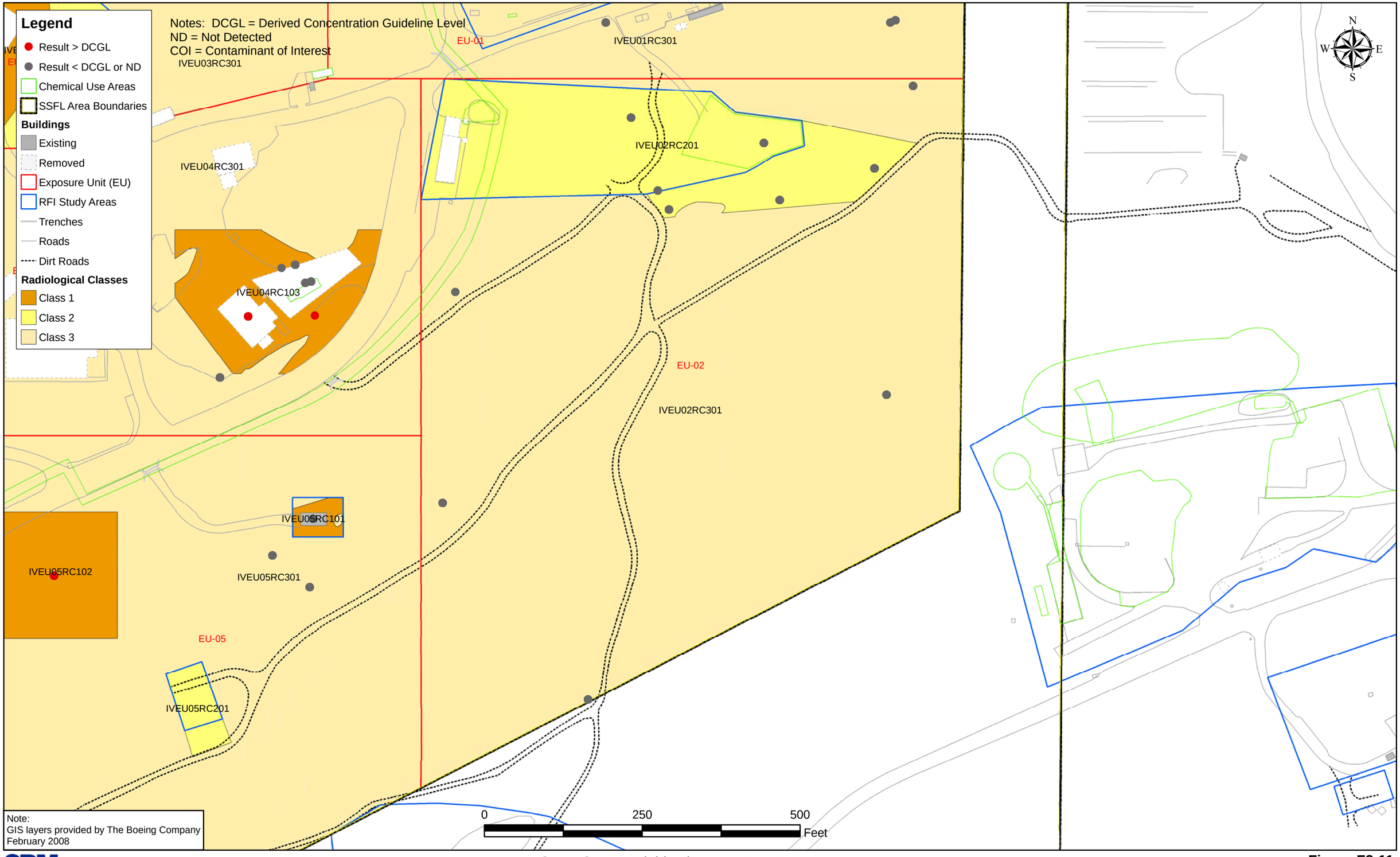
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-10
Dioxin COIs in Soils - EU-02
(2-10 ft bgs)



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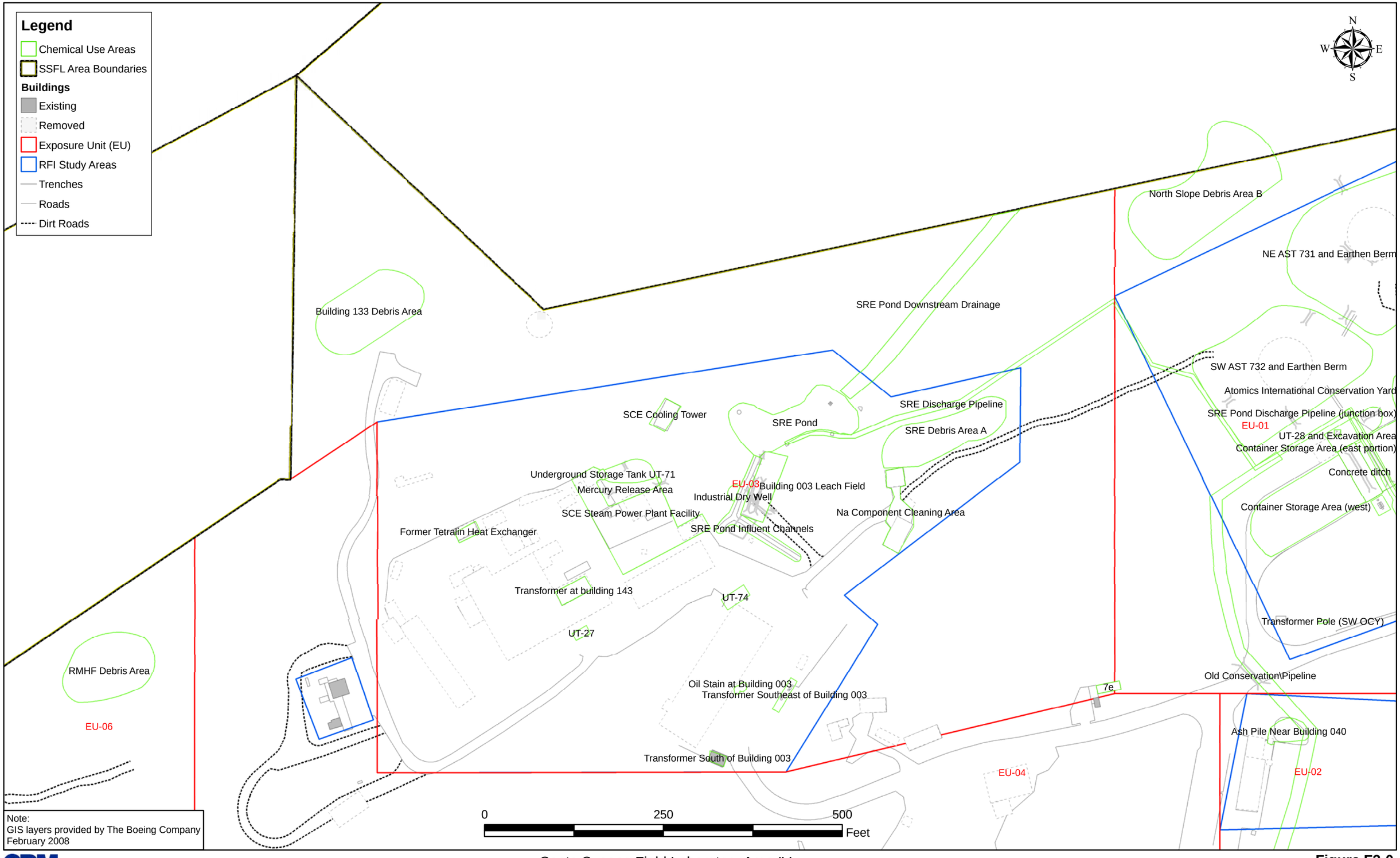
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F2-11
Radiological COIs in Soils - EU-02
(0-6 in bgs)



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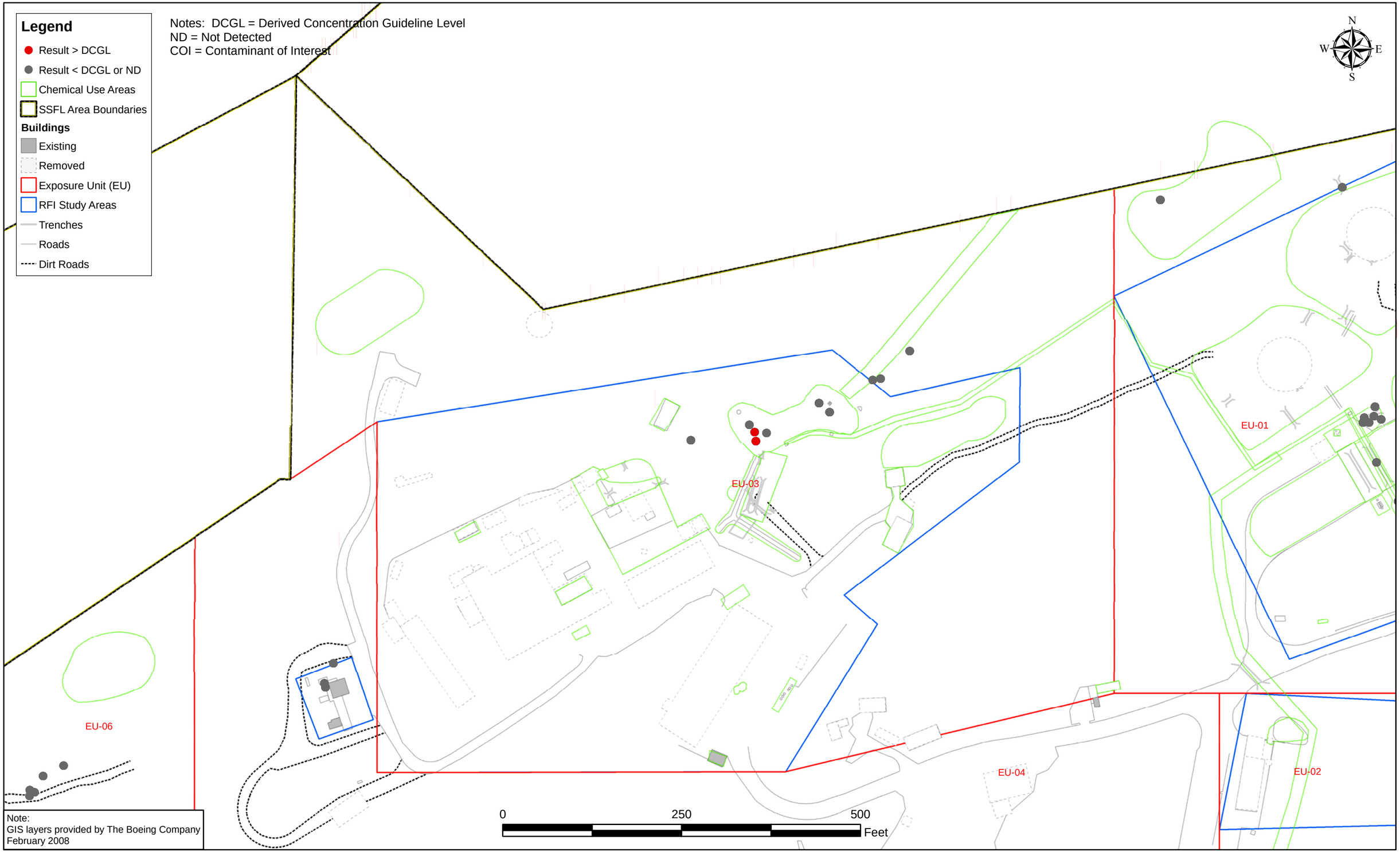
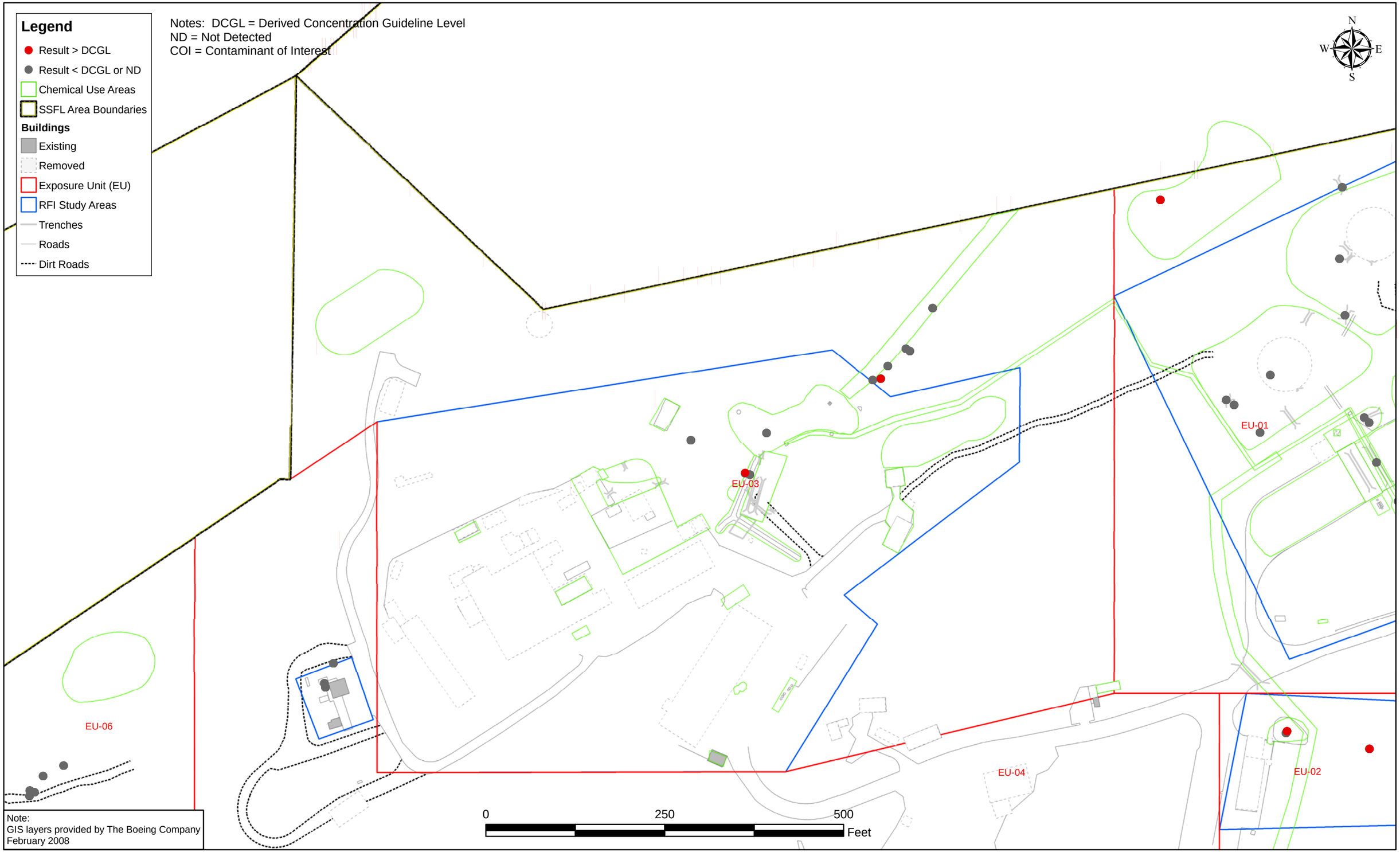
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F3-0
EU-03 Chemical Use Areas



Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F3-1
VOC COIs in Soils - EU-03
(0-2 ft bgs)



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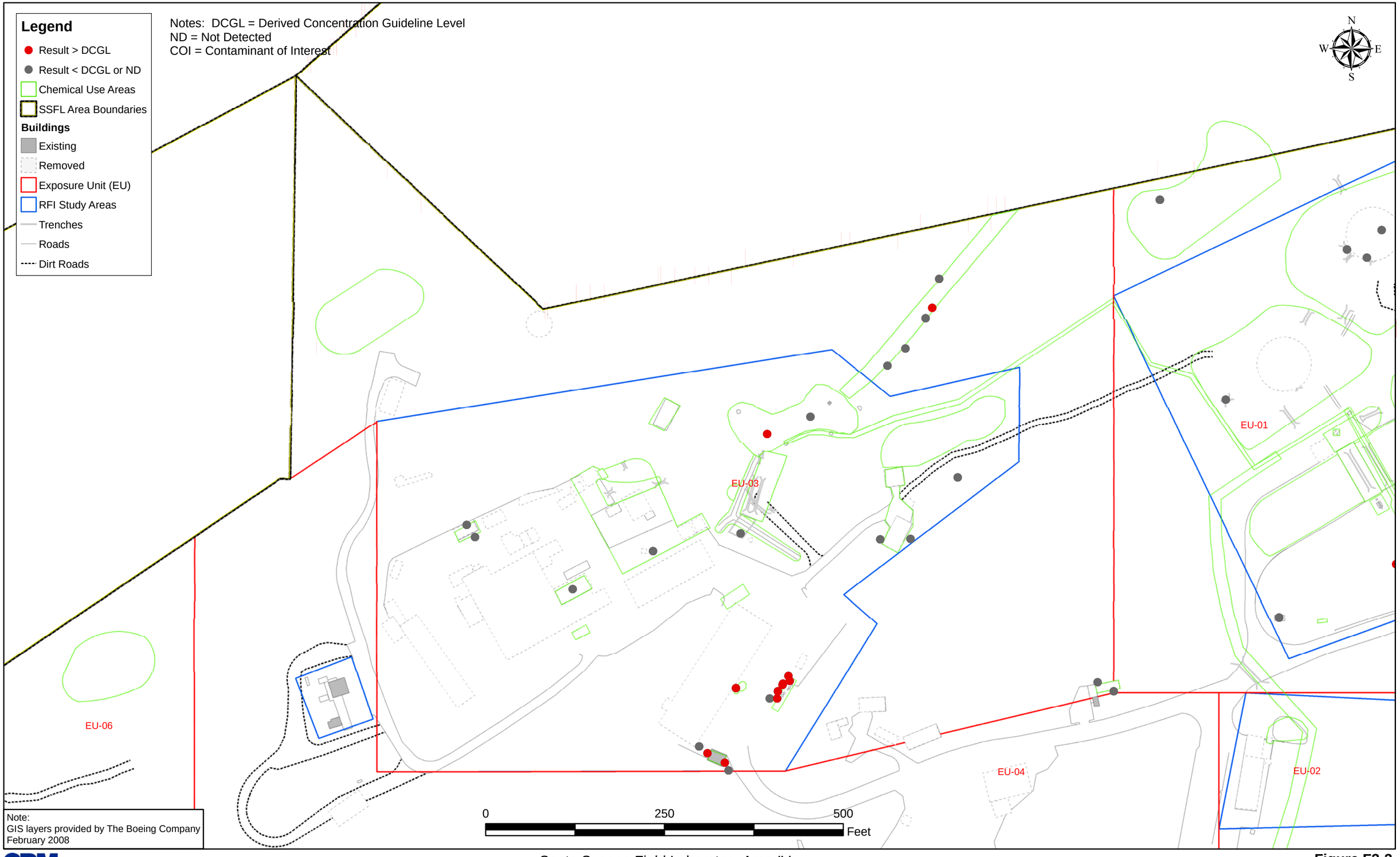
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F3-2
SVOC COIs in Soils - EU-03
(0-2 ft bgs)



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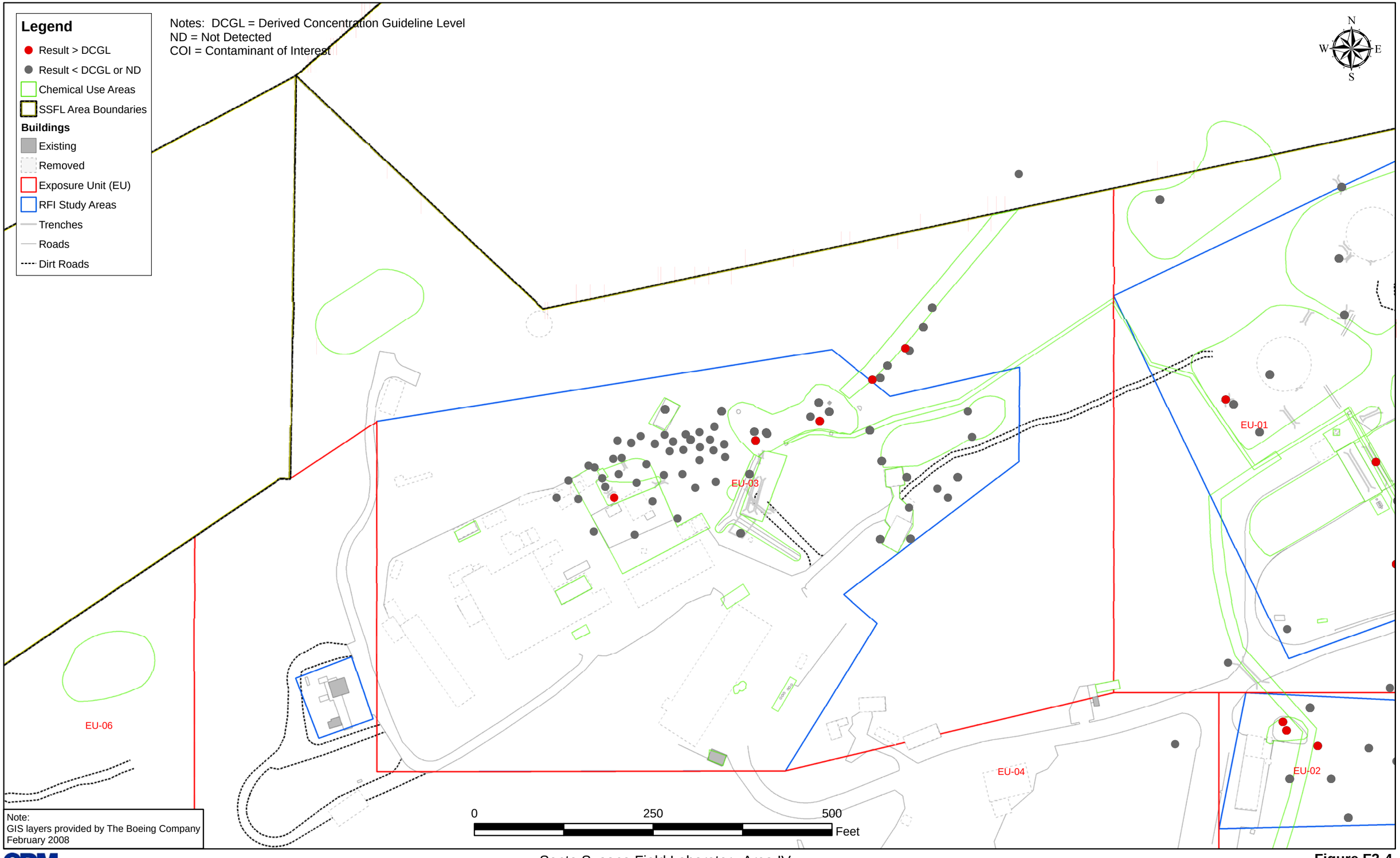
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F3-3
PCB COIs in Soils - EU-03
(0-2 ft bgs)



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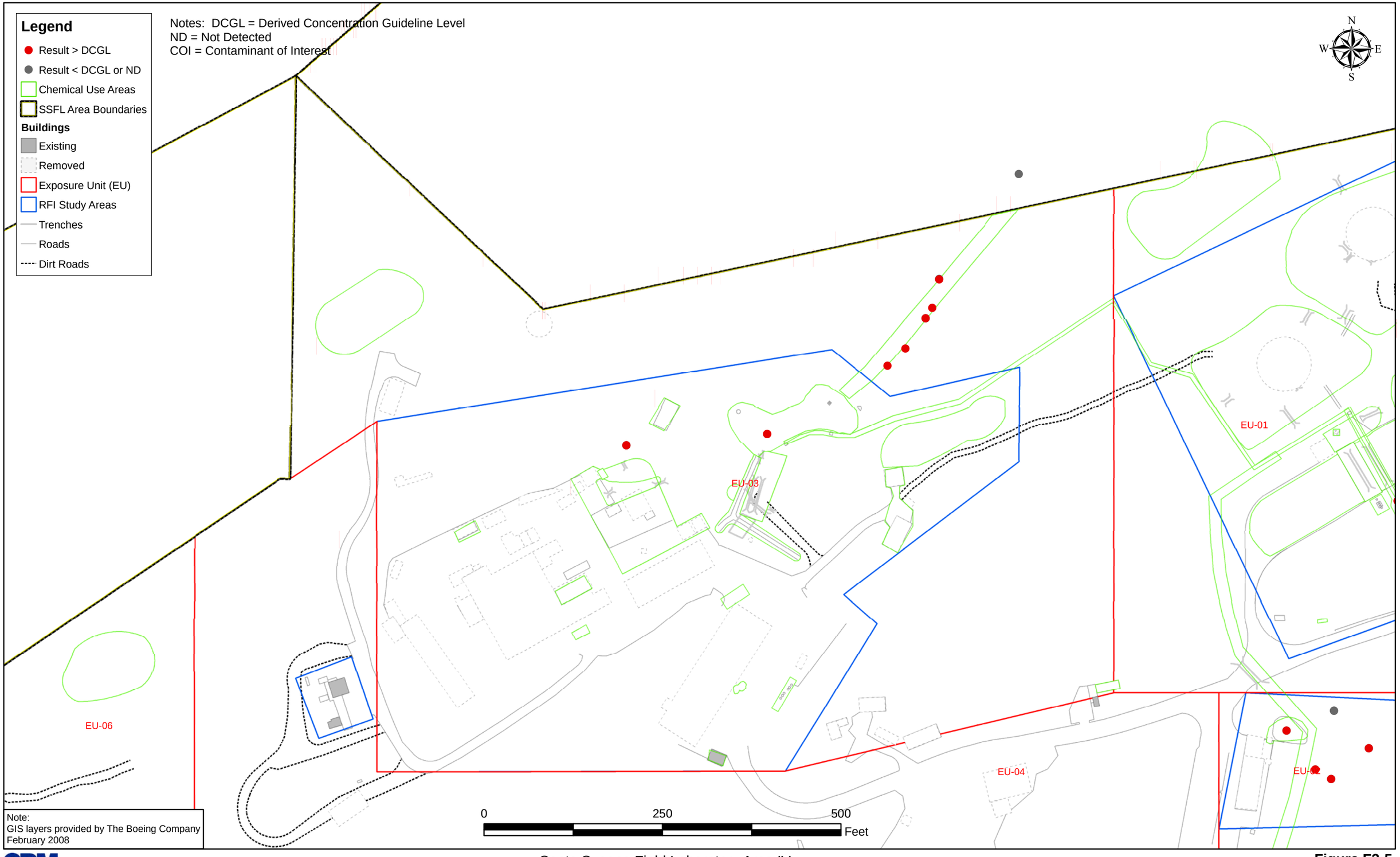
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F3-4
Inorganic COIs in Soils - EU-03
(0-2 ft bgs)



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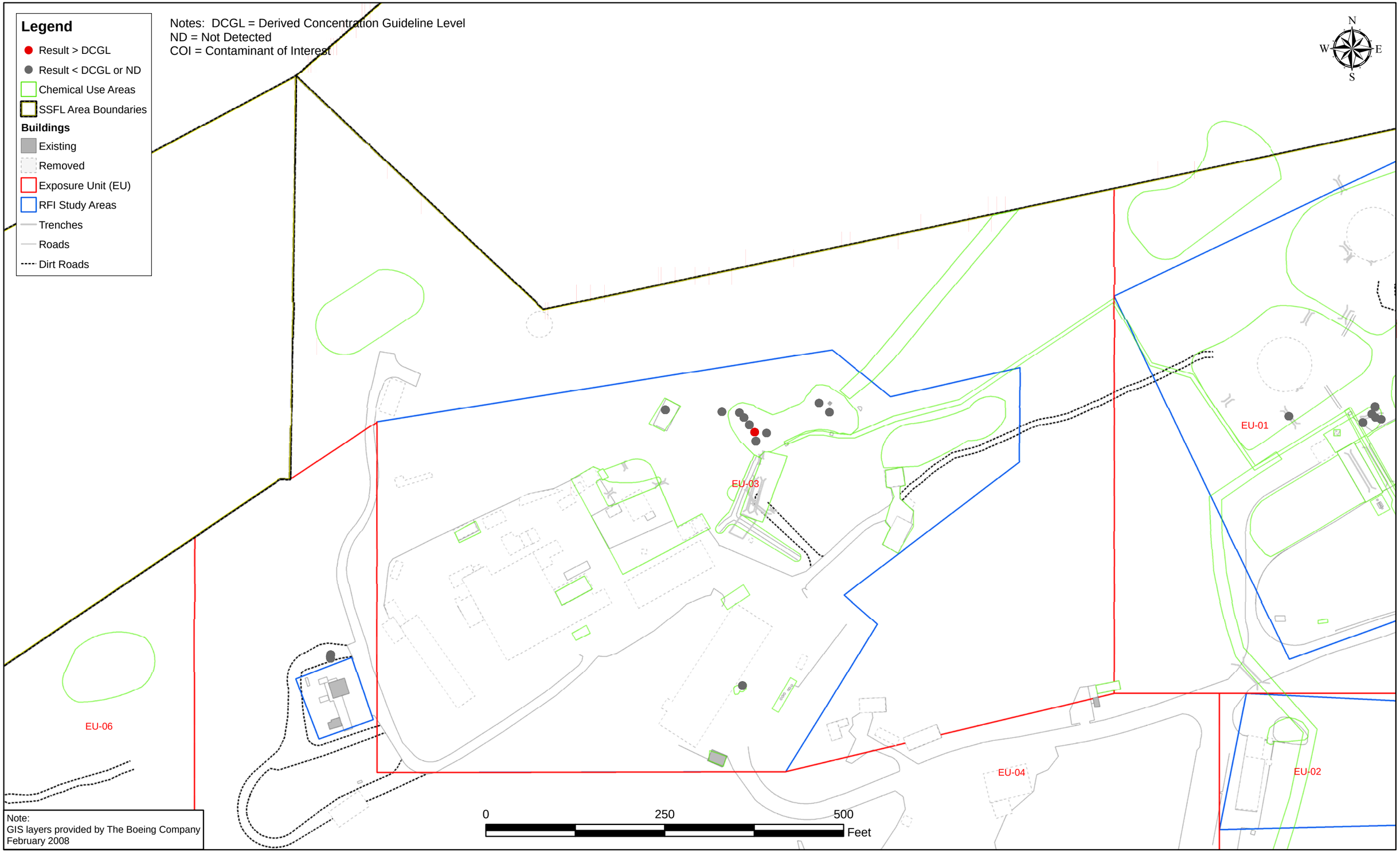
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F3-5
Dioxin COIs in Soils - EU-03
(0-2 ft bgs)



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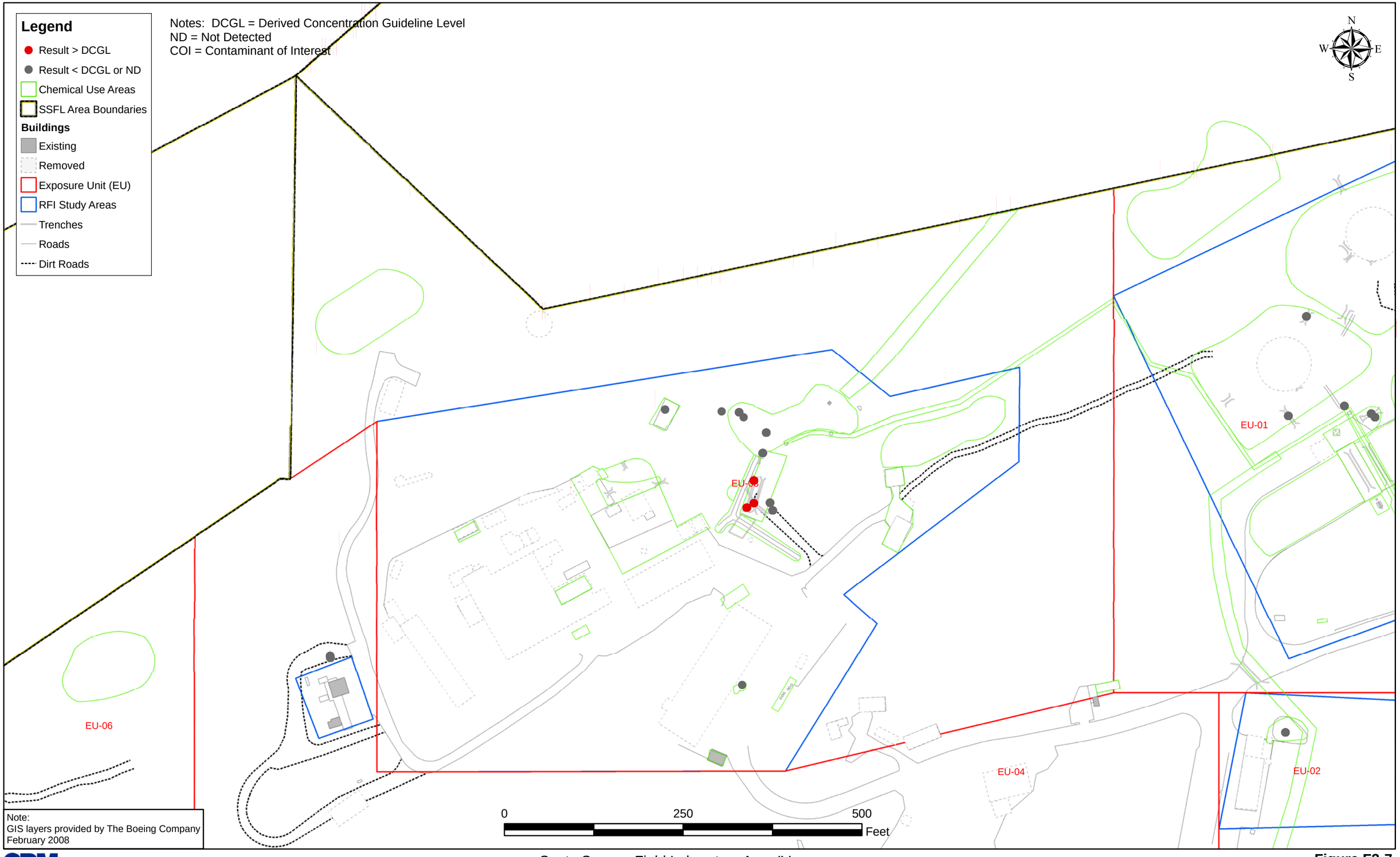
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F3-6
VOC COIs in Soils - EU-03
(2-10 ft bgs)



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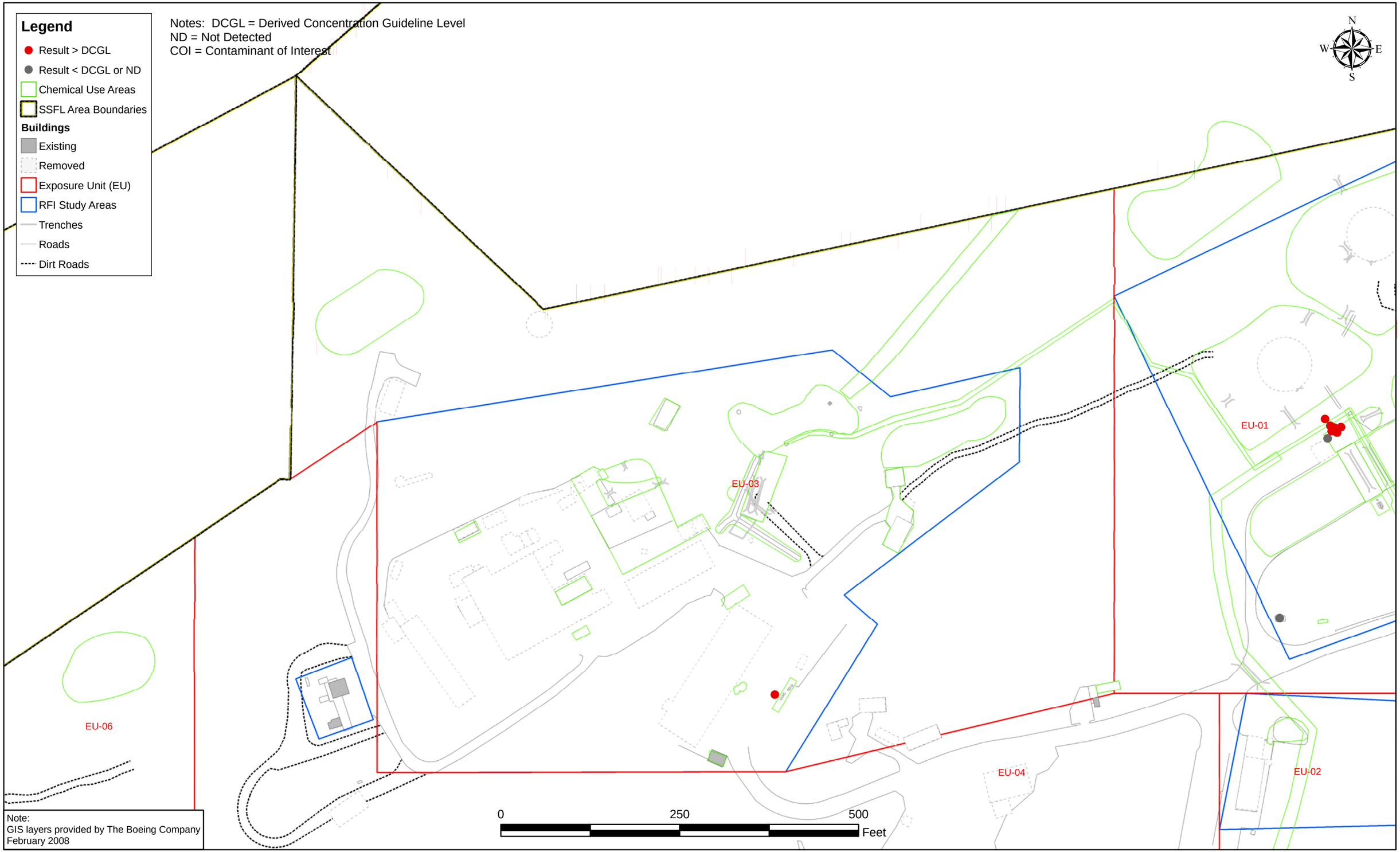
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure F3-7
SVOC COIs in Soils - EU-03
(2-10 ft bgs)



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Ventura County, California

Figure F3-8
PCB COIs in Soils - EU-03
(2-10 ft bgs)