

APPENDIX E. SOIL SAMPLING DATA

The impacts of Alternatives 1 and 2 and the No Action Alternative described in this environmental assessment (EA) are based on soil sampling data collected on Area IV by Rocketdyne. This appendix provides a discussion of the quality assurance of this data and an explanation of its use in the EA.

Two sets of soil data were used to characterize the soil at Area IV:

- 149 predominantly surface soil data taken during the 1994-95 Area IV Radiological Characterization Survey (A4CM-ZR-0011) (Rocketdyne 1996). These soil samples were analyzed for gamma-emitting radionuclides, isotopic thorium, isotopic uranium, isotopic plutonium, strontium-90, and tritium.
- 29 surface soil samples taken during 2000 at the Radioactive Materials Handling Facility (RMHF). These soil samples were analyzed for gamma-emitting radionuclides.

The California Department of Health Services, Environmental Management Branch observed the Area IV fieldwork and took 10 percent split soil samples. The analysis of those soil samples confirmed the Rocketdyne data, and the results were published in the Department's *1995 Annual Report of the DOE/Department of Health Services Agreement-in-Principle* (DHS 1995).

EPA ISSUES WITH AREA IV METHODOLOGY

Issue 1. EPA questioned the detectability and sensitivity of 7-meter by 7-meter (25-foot by 25-foot) spacing for 1-meter (3-foot), 1-minute gamma exposure measurements.

Response:

- These measurements were used to map gamma exposure at 1 meter for Area IV to compare to the U.S. Department of Energy's (DOE's) 5400.5 20-microRoentgen per hour action level and Rocketdyne's 5-microRoentgen per hour action level. It is noteworthy to point out that the proposed EPA survey of Area IV does not intend to map 1-meter exposures.
- Method was not designed or intended to detect all potential levels of contamination at all depths.
- The surface scanning of ground over every square foot was designed to detect hot spots.
- The offsite multi-media sampling survey, conducted in 1992 and 1994, had the same objective as the Area IV survey—to identify any potential contamination from Rocketdyne operations. The Environmental Protection Agency (EPA) participated in the offsite survey. Neither exposure mapping nor surface scanning was performed for the offsite survey. See *Multimedia Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservatory* (McLaren-Hart 1993), and *Additional Soil and Water Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservatory* (McLaren-Hart 1995).

Issue 2. EPA questioned the correlation of the counts per minute from Sodium Iodide detectors, used in the field, with the microRoentgen per hour of a pressurized ionization chamber at a fixed location.

Response:

- Correlation measured thrice daily and applied to daily field measurements.
- Later measurements with Department of Health Services Radiologic Health Branch at different locations at Santa Susana Field Laboratory (SSFL), verified that correlation varied by no more than ± 5 percent, which was less than the daily variability at a fixed location.
- When tested against radioactive waste at RMHF, Sodium Iodide detectors over-respond (conservatively) compared to pressurized ionization chambers.

Issue 3. EPA recommended the use of an 8-centimeter by 8-centimeter (3-inch by 3-inch) Sodium Iodide probe instead of a 3-centimeter by 3-centimeter (1-inch by 1-inch) Sodium Iodide probe for the 1-meter (3-foot), 1-minute measurements and use of multiple detectors.

Response:

- The instruments used were adequate for the purpose of mapping the Area IV exposure levels. The 1-meter (3-foot) measurements are not designed to detect low levels of contamination. They are designed to measure radiation levels to which persons are exposed.
- These measurements were not designed, or intended, to detect all potential levels of contamination at all depths.
- Dual, redundant detectors were used for quality control.

Issue 4. Surface scanning speed was too fast.

Response:

- Description of scan process in final report was misleading.
- Procedures required a side-to-side scan speed of approximately 1 foot per second across a 1.5-meter (5-foot) wide strip while standing stationary. One step forward, then repeat. Thus, the probe head is no more than 15 centimeters (6 inches) away from any point on the soil surface.
- Subsequent surface scanning, based on the same protocol, performed for the MARSSIM survey of the Hot Lab, has an actual scan sensitivity of 10.3 picocuries per gram of cesium-137, compared to a required scan sensitivity, derived concentration guideline (elevated measurement concentration), of 12.9 picocuries per gram.

Issue 5. “Anomalies” such as higher exposures at the edge of a grid blocks were not investigated.

Response:

- All exposure plots provided in the Area IV Survey Report were gaussian, indicating that there were no “anomalies” or indicators of contamination.

Issue 6. Criteria used to determine soil sample location (exceeding 5-microRoentgen/h) could have missed buried contamination.

Response:

- Only 12 soil sample locations were identified based on surface scan.
- Five other criteria were used to identify locations for 137 other soil samples.
- Scan sensitivity is less than MARSSIM derived concentration guideline (elevated measurement concentration) for cesium-137.
- All surface surveys (including EPA's) could be criticized as not guaranteeing detection of undefined subsurface contamination at undefined depth.

Issue 7a. EPA asked what formal data validation of laboratory data was performed.

Response:

- The Area IV Sampling and Analysis Plan describes the data validation process for soil sample analysis and includes the following:
 - Field data-sheets were reviewed for completeness and clarity.
 - Laboratory analysis reports were reviewed for completeness and conformance to the lab request and to verify that sample serial numbers in each batch corresponded to serial numbers reported in of analysis reports.
 - Chain-of-custody forms were reviewed for continuity.
 - Analysis results were reviewed to ensure reported radionuclide concentrations were consistent with method detection limits.
 - Anomalous or questionable results were reported to the laboratory and re-analyses requested. This was done for only four samples.
 - All Quality Control sample results were analyzed to determine factors such as precision and accuracy for each isotope. These results are reported in the Quality Assurance section of the Area IV Survey Report.
 - Blind Field Duplicates. 5 percent of scheduled samples. 88 percent pass rate.
 - Laboratory Duplicates. 7 percent of scheduled samples. 93 percent pass rate.
 - Laboratory Control Samples. 9 percent of scheduled samples. 99 percent pass rate.
 - Laboratory Blanks. 9 percent of scheduled samples. 96 percent pass rate.
 - Rinsate Samples. 5 percent of scheduled samples. 97 percent pass rate.
 - Department of Health Services Field Duplicates. 8 percent of scheduled samples. 69 percent pass rate.
 - Each data package received from the laboratory for every batch of soil samples (either 10 or 20 samples per batch) consisted of:
 - Case narrative (provided in the data appendix of the Area IV Survey Report)
 - Data summary (provided in the report appendix)
 - Chain-of-custodies
 - In addition, the laboratory prepared for each batch of samples:
 - Aliquot information
 - Preparation log for Quality Control samples
 - Calibration data for liquid scintillation counter—copies of raw data sheets including calibration data for gamma spectrometer

- In conclusion, the tabulation of Quality Control samples in Appendix G of the Area IV Survey Report is comprehensive and thorough.

Issue 7b. Laboratory data in Volumes II, III, and IV of the Area IV Survey Report were hard to follow.

Response:

In hindsight, Rocketdyne concurs that a better job of segregating the laboratory data could have been done. The raw data were exhaustively tabulated, graphed, statistically analyzed, and interpreted in the main body of the report, for the very reason that the raw lab data would be impossible to assimilate for the casual reader. Perhaps because of this, less effort was devoted to indexing/annotating/titling the raw laboratory data in Volumes II to IV. The laboratory reports were actually ordered chronologically, because any other way would have been even more confusing. In situations where re-analysis was requested and/or voluntarily performed by the laboratory, both original and re-analysis results are given in the chronological order in which the results were received.

Issue 7c. Little information was provided on the remediation activities in the rest of Area IV.

Response:

- The decommissioning and decontamination and radiological surveys of nuclear facilities by Rocketdyne, the independent verification surveys by third parties and regulatory agencies, and the radiological release process have been documented in numerous reports. These activities are driven and controlled by regulation.
- The (as then) current status of facilities was documented extensively in the Area IV Radiological Characterization Plan when it was issued.

Issue 8. EPA questioned the consistency between 5 microRoentgen per hour and 15 millirem (mrem) per year.

Response:

- The 5 microRoentgen per hour action level used and its translation into 44 mrem per year appears to be inconsistent with a cleanup standard of 15 mrem per year. This illustrates one of the problems with imposing cleanup goals that are very much lower than the variability of natural background.
- Instrument readings were not used exclusively to determine where we would take soil samples.
- Only 12 of 149 samples were taken because the 5 microRoentgen per hour level was exceeded.
- Use of a 1.7 microRoentgen per hour action level (equivalent to 15 mrem per year) would not be practical. Indeed use of 5 microRoentgen per hour is often problematic.
- Full range of exposure in Area IV was 6 to 21.4 microRoentgen per hour (mean = 14.6 ± 3.6 microRoentgen per hour).
- Thus, 5 microRoentgen per hour is less than the ± 2 sigma spread.
- There was no correlation between measured contamination in soil samples and exposure levels.

- Exposure levels in Area IV are primarily a function of ground cover (grass, soil, concrete, asphalt), proximity to buildings, tree cover, and proximity to sandstone rock.

CRITICISM OF SAMPLING DENSITY (1 SAMPLE EVERY 2 ACRES) AS TOO SMALL

Response: Determining the impacts of cleanup of the ETEC site to particular cleanup standards required estimates of the soil excavation needed in Area IV to meet the cleanup goal. Although all remediation sites have had extensive pre- and post-remedial soil sampling performed, those sites are not individually characteristic of the balance of Area IV. The soil data for a specific small area site (several acres) should not be considered characteristic of all 1.2 square kilometers (290 acres) of Area IV. The only comprehensive set of soil samples taken in the non-remediated portions of Area IV were the Area IV survey samples taken in 1994-95. Therefore, this soil sample distribution was used to characterize the balance of Area IV soil. A pre-remediation soil sample data set was available for the RMHF and therefore was used to estimate relative impacts of RMHF soil excavation.

The assumption that the Area IV data set is representative of the all soil (including subsurface soil) at Area IV is extremely conservative. Use of Area IV survey data does not result in a low estimate of the excavated soil volume for Alternative 2; indeed the estimate is a large fraction (15 percent) of all Area IV soil.

The 149 soil samples taken in the 1994-95 Area IV Radiological Characterization Survey are actually a small fraction of the total number of soil samples taken in Area IV. A total of 25 of 28 original radiological facilities have been remediated in Area IV. Soil samples have been taken at the majority of these facilities, both prior to remediation, during remediation and post-remediation as part of final status surveys. In addition to Rocketdyne, several other organizations have taken verification samples, including Oak Ridge Associated Universities, Oak Ridge Institute of Science and Education, Argonne National Laboratories, California Department of Health Services Radiological Health Branch, and the California Department of Health Services Environmental Management Branch. Table E-1 gives a summary of the more than 1,600 post remedial soil samples associated with final status surveys. Because of the "as low as reasonably achievable" (ALARA) process, all soil samples are considerably less than approved cleanup standards equivalent to Alternative 1 and most are within the distribution of local background.

In addition to these samples, additional samples have been taken subsequent to the Area IV survey during excavation of septic tanks and leachfields at Buildings 4005, 4006, 4009, 4011, 4100, 4143, 4353, 4373, and 4487. No contamination has been observed. Soil samples have also been taken associated with the metal debris field at the Old Conservation Yard and at the recent installation of shallow piezometer wells in Area IV. No contamination has been observed.

In two recent MARSSIM designed soil surveys at Area IV, Rocketdyne used sample densities of 35 to 40 samples per acre for Class 1 survey units. Sample densities were calculated using MARSSIM statistical protocols, based on a 15 millirem per year ($\sim 3 \times 10^{-4}$) cleanup standard for cesium-137 of 9.2 picocuries per gram, measured a priori cesium distributions, and α and β error factors of 0.05.

REFERENCES

DHS (California Department of Health Services), 1995. *1995 Annual Report of the DOE/Department of Health Services Agreement-in-Principle*, prepared by the Environmental Management Branch, September 30, 1995.

McLaren-Hart, 1995. *Additional Soil and Water Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservatory*, McLaren-Hart, January 19, 1995.

McLaren-Hart, 1993. *Multimedia Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservatory*, March 10, 1993.

Rocketdyne, 1996. *Area IV Radiological Characterization Survey, Final Report*, A4CM-ZR-0011, Revision A, Rockwell International, Rocketdyne Division, August 15, 1996.

Facility Number	Facility Title	Rocketdyne Operations	Verification Surveys	Rocketdyne	ORISE	DHS	Other
OCY	Old Conservation Yard	D&D and survey complete	ORISE, DHS	20	1	*	-
RMHF	Radioactive Materials Handling Facility	Operational	-	TBD	TBD	TBD	-
003	Engineering Test Building	D&D and survey complete	ANL	15	-	-	9 (ANL)
005	Uranium Carbide Fuel Facility	D&D and survey complete	ORISE, DHS	59	2	*	-
009	Organic Moderated Reactor, Sodium Graphite Reactor	D&D and survey complete	DHS	199	-	-	-
011	Radiation Instrument Calibration Laboratory	Survey complete	DHS	-	-	-	-
010	SNAP-8 Experimental Reactor	D&D and survey complete	ANL	60	-	-	25 (ANL)
012	SNAP Critical Facility	D&D and survey complete	ORISE, DHS	-	-	-	-
17th St.	17th St. Drainage Area	D&D and survey complete	ORISE, DHS	22 + 24	8	*	-
019	Flight System Critical Assembly	D&D and survey complete	ORISE, DHS	-	-	-	-
020	Hot Lab Bldg.	D&D and survey complete	DHS	See below	See below	See below	-
020	Hot Lab Land	Survey complete	ORISE, DHS	85 + 216 + 195	20+10+12	*	-
023	Corrosion Test Loop	D&D and survey complete	ORISE, DHS	-	-	-	-
024	SNAP Environmental Test Facility	Operational	-	TBD	TBD	TBD	-
028	Shield Test Irradiation Reactor	D&D and survey complete	ORISE, DHS	-	-	-	-
029	Radiation Measurement Facility	D&D and survey complete	ORISE, DHS	4	-	-	-
030	van de Graaf Accelerator	D&D and survey complete	ORISE, DHS	-	-	-	-
055	Nuclear Materials Development Facility	D&D and survey complete	ORAU	36	20	-	-
059	SNAP Ground Prototype Test Building	Phase I D&D and survey complete	ORISE, DHS	See below	See below	See below	-
059	059 Land	-	-	TBD	TBD	TBD	-
064	Fuel Storage Facility	D&D and survey complete	ORISE, DHS	See below	See below	See below	-
064SY	064 Side Yard and land	D&D and survey complete	ORISE, DHS	52 + 136	21	*	-
073	Kinetic Experiment Water Boiler	D&D and survey complete	ANL	23	-	-	124 (ANL)
093	L-85 Reactor	D&D and survey complete	ORAU	5 + 12	6	-	-
100	Fast Critical Experiment	D&D and survey complete	NRC	-	-	-	-

Facility Number	Facility Title	Rocketdyne Operations	Verification Surveys	Rocketdyne	ORISE	DHS	Other
	Laboratory						
143	Sodium Reactor Experiment	D&D and survey complete	ANL	~ 40 +	-	-	~ 40 (ANL)
363	R&D Laboratory	D&D and survey complete	ORISE, DHS	-	-	-	-
373	SNAP Critical Facility	D&D and survey complete	DHS (document review only)	-	-	-	-
654	Interim Storage Facility	D&D and survey complete	ORISE, DHS	93	16	*	-
886	Sodium Disposal Facility	Rad. D&D and survey complete	DHS	109	-	13	10 (RWQCB)
Area IV	Area IV SSFL (1994-95)	Nuclear Research	DHS	149	-	12	-
Area IV	Miscellaneous	Miscellaneous	-	~ 50			-
Total				1,604	104	25+	208

* Verification survey report has not been provided.