



Department of Energy

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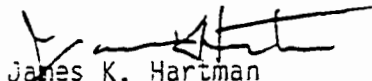
Dear Mr. Nagamatsu:

Enclosed is a copy of the Oak Ridge Associated Universities (ORAU) report on their September 1989 review of Rocketdyne's radiological monitoring practices. The overall conclusions of the report have been discussed between Mr. James D. Berger, the leader of the review team, and Mr. Robert Tuttle of your staff. The report was also provided to EPA's SSFL regulatory agency Work Group at the December 14, 1989 meeting in Simi Valley.

The report indicates that the review identified no evidence of radiological conditions which pose an imminent threat to public health or the environment, and that Rocketdyne's radiological monitoring program has a strong basic foundation of capabilities in its staff, equipment, and procedures. The report also provides a list of recommendations which ORAU believes would strengthen the Rocketdyne program.

It is DOE's intent to provide the most complete and thorough radiological monitoring of DOE's activities and sites that can be reasonably achieved. Therefore, Rocketdyne is requested to respond to the ORAU report recommendations with a proposed corrective action plan which would provide a plan of action to address each of the suggested improvements contained in the ORAU report. Once DOE has reviewed the proposed corrective action plan and approved it, Rocketdyne will be requested to implement the plan and to provide regular progress reports on the implementation.


Should you have any questions on this request, please contact Mr. Gary Lavagnino at (415) 273-6597.


James K. Hartman
Team Leader
ETEC Environmental Review

Enclosure

cc: Steve Lafflam, RD
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Energy
Environment
Systems Division

December 12, 1989

Mr. William E. Murphie
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SFMP Project Manager
Decontamination and
Decommissioning Division
Office of Environmental Restoration
and Waste Management
Washington, D.C. 20545

Subject: REVIEW OF SURPLUS FACILITIES RADIOLOGICAL MONITORING
AT SANTA SUSANA SITE - FINAL REPORT

Dear Mr. Murphie:

Enclosed is the final report of ORAU's review of the Santa Susana Field Laboratories (SSFL) radiological monitoring program as related to identifying, characterizing, and decommissioning surplus facilities. This report incorporates comments received from Mr. Hartman of the San Francisco Operations Office and Mr. Tuttle of Rockwell.

If there are questions or comments regarding this document, they may be referred to me at FTS 626-3305.

Sincerely,



James D. Berger, Director
Environmental Survey and
Site Assessment Program

JDB:jls

Enclosure

cc: J. Hartman, DOE/SAN
M. Harmon, DOE/EM

REVIEW OF SURPLUS FACILITIES RADIOLOGICAL MONITORING
SANTA SUSANA FIELD LABORATORIES
VENTURA COUNTY, CALIFORNIA

Prepared by

J. D. Berger

Environmental Survey and Site Assessment Program
Oak Ridge Associated Universities

INTRODUCTION

In May 1988, the Department of Energy (DOE) conducted an internal review of environmental activities in Area IV at the Rockwell/Rocketdyne-operated Santa Susana Field Laboratories (SSFL) Site in Ventura County, California. While this survey did not find evidence of environmental problems, representing an immediate threat to human health, it did identify the presence of facilities and land areas containing residual hazardous and/or radiological substances from previous site operations. These residual materials are considered potential sources of soil and/or groundwater contamination; several areas of groundwater contamination by chlorinated organics were also identified, and an expanded groundwater monitoring program was recommended.

Findings of this survey generated concern by residents of surrounding communities. In response to these concerns the Environmental Protection Agency (EPA) Region IX created a Work Group to ensure coordinated environmental regulatory management of this site and on July 12-13, 1989, a site inspection was conducted by the EPA Region IX Emergency Response Unit. This inspection also identified some deficiencies in the SSFL environmental radiological

Prepared by the Energy/Environment Systems Division of Oak Ridge Associated Universities, Oak Ridge, Tennessee, under Contract DE-AC05-76OR00033 with the U.S. Department of Energy.

December 12, 1989

monitoring program, but it concurred with the 1988 DOE survey findings that the site does not represent an imminent health or environmental hazard.

Results of the DOE and EPA surveys, indicating radioactive material contamination of facilities and land areas and identifying deficiencies in the SSFL radiological monitoring program, raised concerns at the DOE San Francisco Operations Office (DOE/SAN) and the DOE Office of Nuclear Energy (DOE/NE), regarding the capabilities of the Rockwell/Rocketdyne program to accurately assess the radiological status of its facilities. The DOE/NE Division of Facility and Site Decommissioning therefore requested that the Environmental Survey and Site Assessment Program of Oak Ridge Associated Universities (ORAU) review the SSFL radiological monitoring program, relative to capabilities for identifying, characterizing, and decommissioning sites associated with past and current DOE activities. Mr. J. D. Berger, Director of the ORAU Environmental Survey and Site Assessment Program (ESSAP), and Dr. C. F. Weaver, Senior Radiochemist with the ESSAP, visited the SSFL Site on September 28-29, 1989. Discussions with SSFL staff members, document reviews, facility tours, and limited independent radiological monitoring of several facilities were conducted at that time. Because of conflicting schedule demands, several key SSFL Radiation and Nuclear Safety staff were unavailable during portions of the site visit; additional documentation was thus requested and was provided to the ORAU reviewers at a later date. The findings and recommendations resulting from the ORAU review are presented in this report.

SITE DESCRIPTION

The Santa Susana Field Laboratories Site is located in southeastern Ventura County, about 47 kilometers (29 miles) northwest of Los Angeles, at the western border of the San Fernando Valley. It is situated on a plateau, near the crest of the Simi hills, about 300 meters (1000 feet) above the Valley floor. Surrounding terrain is rugged; zoning of neighboring property is rural or rural-agricultural. The nearest resident is about 2.1 kilometers (1.3 miles) to the southeast. Population density in 1980 was estimated at

about 8,000,000 persons within 80 km (50 mi) of the site. The climate of the region is subtropical with mean monthly temperatures ranging from 10° C to the mid 20's; the region is semi-arid with a mean rainfall of about 45 cm (17.5 in).

The site comprises a total of approximately 1090 hectares (2700 acres) and is divided into four administrative areas (Areas I-IV) and a Buffer Zone. DOE programs are conducted in Area IV of the SSFL Site. This area consists of about 117 ha (290 acres), owned by Rockwell, of which 36 ha (90 acres) are DOE optioned land.

Since the early 1950s, Rockwell and its predecessor organizations have conducted programs in Area IV of the SSFL for the Atomic Energy Commission, Energy Research and Development Administration, and their successor, the Department of Energy. These programs have included engineering, research and development, testing, and manufacturing operations, primarily related to nuclear reactor systems and components. In 1966 the Energy Technology Engineering Center (ETEC) was established at this Site to provide engineering, development, and testing of components for the Liquid Metal Fast Breeder Reactor Program. Although primarily conducting programs for DOE, the site has also conducted activities for the Nuclear Regulatory Commission, Department of Defense, and other government related or affiliated organizations and agencies.

Numerous facilities and associated land areas have become contaminated -- either as a result of their intentional use with radioactive material or inadvertently -- with low-levels of radioactivity. Potential radioactive contaminants identified at this site include uranium (depleted, natural, and enriched), plutonium, americium-241, fission products (primarily cesium-137, and strontium-90), activation products (cobalt-60, europium-152, nickel-63, promethium-147, and tantalum-182) and tritium. As facilities were removed from service, Rockwell performed decontamination and/or stabilization. In 1985 Rockwell/Rocketdyne initiated a project to survey or resurvey selected sites where knowledge of the radiological status was felt to be inadequate.

FINDINGS

Staffing

The radiological monitoring program responsibilities reside with the Radiation and Nuclear Safety group, managed by Mr. R. J. Tuttle. In addition to the manager there are seven professional level staff positions in the group, of which one is a contact position. The Radiation and Nuclear Safety group is supported by Radiation Instrument Services (three staff positions). Most of the individuals in these organizations have multiple years of experience in radiological monitoring and control related activities at SSFL; several of the key individuals have been at the SSFL for 25-35 years and are thus well acquainted with site activities and the history of radioactive materials usage at the site. At the present time there are two vacancies on the Radiation and Nuclear Safety staff and one vacancy on the Radiation Instrument Services staff; replacement of these vacancies is being pursued. In addition, the head of the laboratory operations has announced intentions to retire in approximately six months; replacement efforts and cross-training in laboratory activities have not yet been initiated. Several staff members appear to have the major portion of the site radiological monitoring responsibilities, without provisions for complete backup in their absences.

Although the current staffing level is considered adequate to perform the necessary radiological monitoring and control services required for routine operations, significant additional demands are being placed on the staff to respond to recent DOE and EPA reviews and concerns of nearby residents, the State of California, federal and state legislative representatives, miscellaneous independent environmental concern organizations, and the media. An increased level of effort to identify and decontaminate all facilities and land areas is being sought. Such demands will likely require additional manpower, beyond that required for day-to-day operations.

Equipment

Portable radiological monitoring and laboratory equipment are state-of-the-art. Portable equipment includes a variety of detectors and display instruments; this equipment is capable of measuring surface activity and exposure rate levels to satisfy the DOE guidelines for decommissioning. This instrumentation appears to be well maintained and calibration was current for the instruments observed during the site visit. Laboratory analytical instrumentation includes a low-background gas proportional counter and a pulse height analyzer with a 15% high-purity germanium gamma detector. The laboratory does not have wet chemistry radio-analytical capabilities. As with the portable instrumentation, the laboratory equipment appeared to be well maintained and calibrated within the established SSFL procedures. (See item 3 for further discussion on calibration.) Although the proportional counter and gamma spectrometer are adequate for most of the radionuclides and sample media anticipated at SSFL, certain specific analyses, e.g. isotopic plutonium, strontium-90, and tritium, must be performed by an outside commercial laboratory. The presence of tritium, promethium-147, and nickel-63 as potential radionuclide contaminants may justify the on-site capabilities for measurement of these low-energy beta emitters in water and on filter papers (smears and air samples); acquisition of a liquid scintillation counter would provide that capability. Implementing wet chemistry capabilities is not considered appropriate with the current staffing levels and anticipated sample load.

Procedures

SSFL has documented procedures for many aspects of the radiological monitoring program; however, detailed standard operating procedures have not been prepared for some activities. For example, collection, preparation, and analysis of samples are described in a document entitled "Radiological Environmental Monitoring Program Sampling Procedures, Analysis Procedures, and

Radioactivity Measurement Methods," but there is not a comparable Rockwell procedure document, describing the methods for performing direct measurements of alpha and beta-gamma surface activity and exposure rates or for performing tests for removable contamination. It should be pointed out that individual facility survey reports do describe instrumentation, measurement techniques, and procedures used. Several of the pertinent radiological procedures reviewed were issued 3 to 5 years ago; they are currently being revised in response to recent audit recommendations.

SSFL has reviewed guidelines for residual radioactivity, relative to land and facility use without radiological controls, presently used by the DOE and NRC, and has adopted the most restrictive of the values when there are differences between the guidelines. The guidelines being used for surface contamination of facilities are those used by both the NRC and DOE's Division of Facility and Site Decommissioning. Exposure rate guidelines at SSFL (5 μ R/h above background) were adopted from NRC practices for reactor facility decommissioning; they are more restrictive than those being used by DOE and for non-reactor NRC-licensed facilities. With exception of Ra-226, Ra-228, thorium, and uranium, neither the DOE or NRC have established generic guidelines for residual concentrations of radionuclides in soil. Instead, such guidelines are developed, as needed, on a site specific basis. Therefore, guidelines for such radionuclides as Cs-137, Sr-90, Pu-239, Ni-63, and Co-60, which are potential contaminants at SSFL, have not been established. Rockwell has been using soil contamination guidelines of 46 pCi/g for gross alpha and 100 pCi/g for gross beta (these values include background). The gross alpha value is comparable to levels for most nuclear fuel cycle materials (uranium and plutonium) which have been used by the NRC. However, guideline levels for Cs-137, Sr-90, and Co-60, which have been used for decommissioning at other DOE and NRC sites, are typically equivalent to less than 100 pCi/g of gross beta activity. Both DOE and NRC have developed procedures for establishing site-specific soil guidelines; Mr. Moore of the SSFL staff attended a DOE workshop on developing guidelines, using the RESRAD program, in mid September. The use of gross alpha and gross beta guidelines for soil is not consistent with the September 1986 DOE directive to report environmental data in terms of

specific radionuclides and does not enable comparisons of contamination levels with established guidelines. In addition, while analysis for gross alpha and gross beta is a useful "screening" technique for soil, it is not a reliable and accurate quantitative technique for radiological analysis of soil. While gross alpha and gross beta analyses were used for determining acceptance of decontaminated soil areas in the past, (in some cases with correlation by other analyses), recent changes in procedures now require gamma spectrometry or other radionuclide specific evaluations. Gross alpha and gross beta analyses continue to serve as screening techniques, particularly in the environmental monitoring program.

Field survey techniques (sampling and measurement) are consistent with those in use by industry, government contractors, and regulatory organizations, involved in facility decommissioning activities. Instrumentation and procedures are capable of measuring surface activity levels with adequate sensitivity to assure that current federal guidelines are being satisfied. SSFL also performs statistical analysis of all survey data to demonstrate, on the basis of cumulative probabilities, that there is greater than a 90% confidence level that guidelines are met. ORAU has had occasion to perform confirmatory evaluations of several Rockwell facilities, which were being decommissioned for release from NRC license restrictions. These included fuel fabrication areas at the DeSoto site (in Canoga Park) and the T055 (mixed oxide) and T093 (L-85 reactor) facilities at SSFL. In each case, it was the finding of the confirmatory survey that Rockwell's decommissioning activities were effective and that data were adequate and accurately described the radiological status of the facility. Several areas where the field survey program could be improved are:

- a. Survey measurements and sampling locations should be referenceable to the state and/or USGS grid system to enable future location, i.e. following facility demolition and possible rebuilding.
- b. Micro-R meters are used to scan soil areas to locate "hot-spots" of gamma-emitting radionuclides for removal. Exposure rate measurements at 1 m above the surface are used for the acceptance survey, following

decontamination. Based on findings of limited EPA and ORAU monitoring at Building T064 (see page 11) the scanning procedure does not appear to be effective in identifying all gamma "hot spots" and the instrumentation and/or technique should be reevaluated.

- c. A comprehensive listing of detection capabilities (sensitivities) for the various field survey equipment and survey techniques should be developed.

With some exceptions, laboratory procedure are also consistent with those used by other organizations performing decommissioning activities. One of the areas of concern is the past reliance on gross alpha and gross beta analyses of soil, rather than conducting specific radionuclide analyses (see earlier discussion - page 7). Another concern, raised by the July 1989 EPA report, was the possible loss by volatilization of cesium and strontium (and possibly other radionuclides) from soil samples, during a drying/ashing cycle at 500° C. Procedures at EPA and DOE analytical labs typically recommend temperatures of 450° C to 480° C, without identifying concern for volatilization of cesium or strontium. Although the ORAU laboratory staff does not believe that volatilization of these two elements should be a potential problem at 500° C, they recommend reducing the temperature to 450° C, to be consistent with other standard procedures. The effect of such temperatures on other potential contaminants should also be evaluated and laboratory procedures adjusted accordingly. In the gamma spectrometry procedures, photopeaks which are potentially encumbered, are being used for determination of certain radionuclides. For example, the 186.2 keV peak is being used for Ra-226 and the ^{185.7}183.7 keV peak for U-235. Difficulties in resolving these close peaks and possible shifts in peak location could result in misidentifying contaminants and/or miscalculating concentrations. Use of alternate photopeaks, such as the Bi-214 (Ra-226 daughter) 609 keV peak (equilibrium status must be considered) and the U-235 143 keV peak, would provide more reliable measurements in cases where both contaminants might be present. To estimate the level of U-238 in soil, the Ra-226 level is being measured, and an equilibrium state is assumed. This approach will greatly underestimate the U-238 level in the case where the

contaminant is processed uranium, such as is the case at SSFL. If gamma spectrometry is to be performed for measuring U-238, either the 1.001 MeV Pa-234m photopeak (very low abundance) or the Th-234 photopeaks at 63 keV or 93 keV (doublet) could be used. Gamma spectrometer calibration does not use a simulated soil matrix. Although the effects are negligible at medium and high photopeak energies, there can be a significant change in calibration at energies below 100 keV. The magnitude of the change will be dependent upon the energy, soil density, content of heavy elements in soil, and counting geometry selected.

The QA (quality assurance) program, relative to radiological monitoring for facility decommissioning, is described in the Rockwell procedures document, "Radiological Environmental Monitoring Program Quality Assurance." While this program is very adequate in many areas, some aspects of the program do not appear to have been implemented and some standard QA requirements have either not been incorporated into the program or should be more specific. Equipment calibration is in accordance with the established SSFL procedures and appropriate for the nuclides of concern; calibration source certificates and calibration records were reviewed and no deficiencies noted. The laboratory and field conduct an adequate QC (quality control) program of regular background and source checks of equipment response; documentation of results is good. Calculation procedures are also well documented with an adequate paper trail of calculational program validation and records of changes to such programs. A chain-of-custody procedure for samples has not been implemented. Although the SSFL procedure requires documentation of personnel qualifications for the various program activities, records supporting training and certification in specific laboratory and field survey procedures could not be provided. Periodic internal audits of limited aspects of the program have been performed by the Radiation and Nuclear Services group management; the frequency of such audits is not specified. The program has not been included in QA audits performed by other Rockwell organizations, DOE, or outside organizations.

The laboratory performs analyses of spike, blank, duplicate, replicate, and split samples, but the minimum frequency or percentage of such control

analyses is not specified. The laboratory also participates in the DOE/EML interlaboratory comparison program for selected radionuclides in air, water, vegetation and soil samples; results have been acceptable, based on a review of 9/88 and 4/89 test results. Although samples for tritium and some other specific nuclide analyses are performed by a commercial laboratory, Rockwell does not include quality control samples (spikes, blanks, and duplicates) to evaluate the performance of such vendors.

Independent Monitoring of Selected Sites

Limited gamma monitoring with a sensitive sodium iodide scintillation detector and countrate meter was performed at five facilities, for the purpose of independently assessing the adequacy of decontamination efforts and/or confirming radiological data and information presented in Rockwell survey documents. Findings are described below:

Conservation Yard

Contaminated surface soil had been recently (August 1988) removed from about a 100 m² area in the Conservation Yard (also known as the Conservation Yard). The contaminant was identified as Cs-137; level was 100 pCi/g (gross beta). The follow-up survey report had not yet completed. Thorough near-surface gamma scans were performed over the remediated area, and random scans were conducted at other locations in the Conservation Yard. There was no evidence of residual surface contamination by gamma emitting radionuclides (the instrumentation used for this survey is capable of identifying small areas of surface Cs-137 contamination at concentrations of less than 10-15 pCi/g).

Old T028 Building Site

Building T028 was originally a small test reactor facility and portions of the building were later used for uranium metal alloy operations. The upper

story of this facility has been removed; a survey in November 1988 concluded that the remaining portions of the facility meet the guidelines for release without radiological restrictions. Limited surface scans were performed in the remaining portions of the building, on the pad (floor of the demolished upper section), and around the surrounding grounds. Ambient background levels in portions of this facility are 3 to 4 times higher than the typical SSFL area background; due to stored radioactive materials at the nearby RMDF facility. This condition decreased the ability to identify very low levels of residual contamination in small areas by the gamma scan; however, as with the Conservation Yard area, no evidence of localized elevated readings, which would suggest significant residual contamination, were detected.

Building T064

Portions of the paved grounds and soils area near the entrance to the T064 (Source and Special Nuclear Material Vault) Building became contaminated in the early 1960s and partial cleanup was performed at that time; more recently (August and September 1989) further remediation was performed. The contaminant was identified as mixed fission products from a leaking (but empty) shipping cask. Cleanup involved excavation of soil to remove an estimated 100 m² of contaminated area. Cleanup was based on meeting a 5 μ R/h (above background) exposure rate at 1 m above the surface and satisfying the gross alpha and gross beta soil levels of 46 pCi/g and 100 pCi/g, respectively. Gamma spectrometry was also performed on soil samples. The report on follow-up monitoring was not yet complete at the time of the review, and SSFL conclusions as to the effectiveness of decontamination were therefore not available. Gamma scanning of the remediated area identified several (about 6) small areas with contact radiation levels 5 to 10 times the ambient background rate. The levels appear to increase with depth. These findings suggest that there is residual subsurface contamination at the site, which may be in excess of the DOE guidelines. Because there is no generic DOE guideline for Cs-137 in soil, SSFL will be evaluating the residual contamination, using the RESRAD program.

General above-background gamma levels and several "hot spots" were noted in a portion of the excavation, containing a clay pipe (similar to tile sewer piping). Radiation and Nuclear Services personnel could not identify the purpose of the pipe or its outfall location. Because of the presence of residual contamination in the vicinity of the exposed section of pipe, there is a question as to whether the pipe had contained radioactively contaminated liquids and whether there was an old leach field in the vicinity of the T064 Building, which might be contaminated.

Sodium Burn Pit

A December 1987 systematic survey of the Old Sodium Disposal Facility (Sodium Burn Pit) revealed areas of surface contamination containing Cs-137, Sr-90, and uranium. This contamination is limited to small isolated areas of the two former evaporation ponds. The survey did not address subsurface conditions; however, the potential for subsurface contamination exists because cleaned items were previously buried near the pit and the integrity of the sodium reacting pool (pit) is unknown. Gamma surface scans of the pad, the two former ponds, and some of the adjacent area, including several surface runoff pathways, identified only several small areas of elevated direct radiation in the ponds. These areas were the same ones identified by the July EPA survey.

Catch Pond and Old Leach Field Area for the Radioactive Material Disposal Facility

Southwest of the Radioactive Material Disposal Facility (RMDF) is catch basin for surface runoff from the facility grounds. The basin and the drainage trough leading to this basin are concrete and have been coated with an asphalt sealer. Contaminants are primarily Cs-137 and Sr-90. Ambient radiation levels in portions of this area were slightly elevated, due to the proximity to the RMDF where radioactive material is processed and stored. Gamma scans did not identify any evidence of surface contamination around the edges of the catch basin, but levels ranging from 10 to 15 times above background were noted on portions of the drainage trough. A thorough survey of this area has not yet been conducted.

To the north of the RMDF there is a land area which was inadvertently contaminated with Cs-137 and Sr-90, due to an accidental release to the facilities leach field and a surface spill from a waste treatment operation. Cleanup was performed in 1978; however there are remaining small areas of surface contamination and residual contamination in cracks in the bedrock. Ambient gamma levels in this area were elevated due to the ongoing RMDF operations. Several small isolated locations of surface radiation, several times the background level, were identified near the old leach field; because of the rugged terrain and limited time for the survey, no monitoring was conducted on the hillside between the RMDF and the leach field. Of the known or suspected contaminated facilities at SSFL, this area is the nearest to the site property line.

Summary of Independent Monitoring

Results of the limited independent monitoring were consistent with the earlier findings of Rockwell and EPA. They also indicate that the Rockwell monitoring program is capable of identifying significant areas of residual radioactive contamination. Although monitoring at two of the sites (the Old Conservation Yard and the T028 facility) indicated that remediations at these sites have likely been effective in reducing residual activity to within the applicable DOE guidelines, small areas of contaminated soil may still be present at the T064 facility.

Status of Site Radiological Conditions

In 1985, SSFL initiated a project to identify facilities in Area IV, which might be contaminated, based on use history, known incidents, and/or previous monitoring information. Twenty-five facilities were identified, and radiological surveys, conducted during 1987 and 1988, confirmed that residual contamination at six of these facilities, was above the current DOE decommissioning guidelines. Rockwell has performed remediation on several of these facilities and has developed a plan to address the remaining facilities, identified during that survey, between now and FY 1994.

Document reviews and discussions with Radiation and Nuclear Services staff indicated that the surveys concentrated on surface conditions and only minimal information is available on subsurface conditions at most of the sites. Prior to installation of the site sewer system, many of the facilities had leach fields to which potentially contaminated liquid wastes could have been discharged; with only a few exceptions, radiological conditions of these former leach fields have not been determined. Subsurface contamination is also possible in the vicinity of the Old Sodium Burn Pit, the RMDF and associated areas such as the catch basin, and other facilities where surface contamination has already been identified. There are other facilities and land areas where radioactive materials were previously used, but which were not included in the 1987 and 1988 survey project. For these reasons it is ORAU's opinion that the extent of radioactive contamination on the SSFL DOE property has not yet been thoroughly determined. It should be noted that the environmental monitoring program at SSFL has not identified any evidence of offsite migration of radioactive contamination in surface runoff or groundwater.

The San Francisco Operations Office of DOE has directed Rockwell to prepare a complete listing of the facilities and sites, where radionuclides have been used at SSFL and to provide copies of documentation which has been developed for those areas.

SUMMARY

At the request of the DOE's Division of Facility and Site Decommissioning Projects, the Environmental Survey and Site Assessment Program of Oak Ridge Associated Universities performed a review of the radiological monitoring program at the Santa Susana Field Laboratories Area IV site during September and October 1989. The review consisted of discussions with SSFL staff, document reviews, facility visits, and limited radiological monitoring. Findings of this review identified no evidence of radiological conditions which pose an imminent threat to public health or the environment. The radiological monitoring program has a strong basic foundation of capabilities in its staff, equipment, and procedures. There are aspects of the program which should be

strengthened. The following section contains a list of recommendations arising from the findings of this review. Many of the deficiencies which were identified are related to activities or lack of activities which could adversely affect or make questionable the quality level of data. It is ORAU's opinion that with relatively minor changes and additions to the present radiological monitoring program, SSFL will be capable of conducting thorough and accurate assessments of the radiological status of the site. Portions of the site have been recently evaluated, but additional data and information are needed to provide a comprehensive evaluation of some of those areas. Current radiological data have not been developed for other portions of the site, some of which may contain residual contamination. An accelerated schedule or expanded scope of site surveys would likely require a level of effort, beyond the currently available resources.

RECOMMENDATIONS

1. Evaluate staffing requirements relative to the current and anticipated workload. Actively pursue staff replacements and additions, as determined appropriate. Initiate plans for replacement of laboratory head. Cross-train staff in key activities to provide backup capabilities.
2. Evaluate potential low-energy beta analytical needs to determine whether acquisition of a liquid scintillation counter would be cost effective.
3. Develop additional detailed procedures, covering aspects of the radiological monitoring program such as monitoring surveys and measurement of surface activity and exposure rates. Finalize revisions of procedures, as appropriate, and establish a regular schedule for procedure review and update.
4. Develop guidelines for residual concentrations of radionuclides in soils at SSFL. It is suggested that the DOE RESRAD program be used for this purpose.
5. Use gross alpha and gross beta soil analysis only for screening purposes; develop radionuclide-specific analyses for evaluating soil contamination levels.
6. Implement referencing of surveys to state and/or USGS grid systems.
7. Review surface gamma scanning procedures for improved identification of "hot-spots" and small areas of contamination.
8. Develop a list of equipment detection capabilities.

9. Modify drying/ashing procedure for soil to reduce the peak temperature to 450° C. Also, evaluate possible effects of temperature on loss of other potential contaminants.
10. Evaluate use of alternate photopeaks for gamma spectrometry of certain radionuclides.
11. Obtain a simulated soil matrix standard for gamma spectrometer calibration.
12. Develop a chain-of-custody procedure for samples.
13. Initiate an auditable program of training and qualification of personnel in radiological monitoring procedures.
14. Develop and implement a program to assure periodic comprehensive audits of radiological monitoring activities, related to decommissioning. This program should include internal audits and audits by Rockwell, DOE, and external agencies.
15. Initiate a program to including quality control samples for evaluating performance of commercial analytical laboratories.
16. Implement a program to systematically characterize the radiological status of the entire SSFL Area IV site. This characterization should include evaluations of surface activity levels on structures and in surface and subsurface soils. The findings should be compared to applicable guidelines, including site-specific guidelines for soil, as established by the DOE's Surplus Facilities Management Program.
17. Conduct additional investigations of questionable conditions, identified at the remediated area of the T064 facility.

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12. "Radiological Survey of the Sodium Disposal Facility - Building T886," GEN-ZR-0004, June 3, 1988.
13. "Radiological Survey of the Source and Special Nuclear Material Storage Vault T064," GEN-ZR-0005, August 19, 1988.
14. "Executive Summary of the DOE SSFL Site Radiological Survey," GEN-ZR-0015, October 10, 1988.
15. "Radiological Survey of the Old Conservation Yard (Salvage Yard)" GEN-ZR-0008.
16. Additional radiological survey reports for facilities T009, T513, Old R/A Laundry Area, Plot 333, areas between SRE and RMDF, areas between KEWB and RMDF, and T028.