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NOV 8 1989

MEMORANDUM

SUBJECT: Rocketdyne SSFL Site Sample Analysis Report

FROM: Gregg D. Dempsey, Chief
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TO: Rich Vaille, Assistant Director
Toxics and Waste Management Division

Attached are the results and my analysis of those results concerning the samples collected at the Rocketdyne Santa Susana Field Laboratory, July 13, 1989. There are several outstanding issues that should be investigated in the future; those items are discussed in the summary of the report. Acceptance and funding of the proposal we first discussed on September 13, 1989, would add to the information needed by providing EPA follow up.

If you decide to make a formal press announcement concerning this report, I would like to be advised and participate, if possible.

I appreciate the help your staff has given me in preparation of this report.

cc: Carmen Santos, Toxics & Waste Management Division
Daniel M. Shane, Emergency Response Unit
Michael Bandrowski, Region 9
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Report on Environmental Samples Collected at the Rocketdyne Santa Susana Field Laboratory July 1989

Gregg Dempsey, Branch Chief
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Office of Radiation Programs
Las Vegas Facility
November 8, 1989

I. FOREWORD

On July 12 and 13, 1989, personnel from the U.S. Environmental Protection Agency went to Rockwell International's Santa Susana Field Laboratory, near Simi Hills, CA to review laboratory operations and collect environmental samples. The samples were collected from specific areas onsite where evidence of radiological or hazardous materials contamination had been found.

This report addresses only radiological analyses performed by the contractor used by EPA for this project, Controls for Environmental Pollution, Inc. (CEP). Samples were collected and shipped with EPA direction by the EPA technical assistance team contractor, Ecology and Environment, Inc.

Delays were encountered during EPA review of CEP data because it was discovered that CEP had made an error that reduced the number of radionuclides that were reported. In order to assure validity and quality of data, EPA requested complete spectral, radioisotope library, and minimum detectable activity data on each environmental sample collected. This review process necessitated that CEP provide additional information and served to delay this report.

EPA is satisfied with CEP data quality. Reanalysis of any sample is unwarranted.

The transmittal submitted to Region 9 by Gregg Dempsey of the Office of Radiation Programs - Las Vegas Facility, dated July 28, 1989, should be referenced for further details on the sample locations discussed in this report.

II. ABBREVIATIONS AND TERMS

Several abbreviations and terms are used in describing the analyses:

1. Gamma Isotopic Analysis - This is an analytical technique which uses a device sensitive to penetrating gamma rays called an intrinsic germanium detector. The sample, be it soil or water, is placed in a specially calibrated counting container, called a counting geometry, for analysis. Soil samples are often dried prior to placement in the counting geometry. A specialized computer is used to record a spectrum of gamma energies which is them compared with two calibration factors - one is an energy calibration which determines that a "peak" in the spectrum is a certain energy, and the other factor takes into account the counting geometry and thereby enables the computer to convert a spectrum into a specific analytical result. Results are often expressed in pCi/L (picocuries per liter) or pCi/g (picocuries per gram). The fact that an analysis can be expressed in terms of

a few picocuries per liter or picocuries per gram often means that the sample has only background levels of radioactivity. In this report, only gamma emitting isotopes that were detected are listed. The counting system is capable of detecting and quantifying many isotopes. To aid the analyst if a specific isotope is sought, a table is often generated to show the minimum detectable activity for nuclides not found in the sample.

2. Natural Gamma Emitters - Just about everything - soil, air, water, food, and living things (including people) contain some small amount of radioactivity that is natural or terrestrial in origin. Most environmental samples will contain some natural radioactivity. These are elements like radium, lead, actinium, thallium, and bismuth. In the report, the specific radium isotope found, radium-226, is abbreviated with the notation Ra-226. In a similar fashion, the lead isotopes encountered are lead-212 and 214, they are abbreviated Pb-212 and Pb-214. Actinium is encountered as actinium-228, abbreviated Ac-228. Thallium is found as thallium-228, abbreviated Tl-228, and bismuth is found as bismuth-214, or Bi-214. Perhaps the most widely found isotope is potassium-40, or K-40.

3. Cesium-137 - A gamma ray emitting isotope of cesium, abbreviated Cs-137. Because of atmospheric testing of nuclear weapons and other activities, Cs-137 is typically found in most types of environmental media. Since it has been produced by, and only by, man's activities, the concentration varies quite a bit from place to place.

4. Tritium - This is the common name for a radioactive isotope of hydrogen, abbreviated H-3. It can be produced in the high atmosphere and is commonly found in surface water in small amounts. Typically, well water or other protected water is very low in tritium, so low, in fact, that it is difficult to measure by common analytical techniques. Tritium is also be produced in nuclear reactors.

5. Liquid Scintillation Counting - This is a laboratory technique used to analyze samples with weak beta emitters, like tritium. The sample, after sometimes being purified through azeotropic distillation or simple distillation, is placed in a scintillation vial and a counting "cocktail" is added. As a beta particle strikes a molecule of cocktail, a photon of light proportional to the energy of the beta particle is given off. This process is called scintillation. These scintillations are counted electronically and are converted into activity in pCi/L using specific calibration factors.

6. Azeotropic Distillation - A method to remove water from soil or other media. Typically, a soil or other type sample is boiled in cyclohexane or another low boiling point organic hydrocarbon. As the cyclohexane boils, water is carried in the vapor and condenses in a special container, where it separates from condensed cyclohexane. Simple distillation of the separated water usually follows to remove other organic materials which can interfere with analysis.

III. ENVIRONMENTAL SAMPLE ANALYTICAL RESULTS

Old Sodium Burn Pit

The Old Sodium Burn Pit was an area where radiologically contaminated materials had been dumped at some time in the past. The area was posted with "Caution - Radioactive Materials" signs around the perimeter of the two pits. Walking surveys with a gamma survey instrument indicated what is probably only background levels of radioactivity. The upper pit had moisture in the soil at its lowest spot. One separate sample plus a duplicate was collected in the upper pit to be analyzed for gamma emitting isotopes and for tritium through azeotropic distillation. One sample was collected in the lower pit for gamma isotopic analysis only since this pit was completely dry.
Results of analyses are below:

Upper Pit

Sample Type: Soil
Requested: Gamma Isotopic, Tritium (by Azeotropic Distillation)

Gamma Results:

K-40	9.76 ± 1.68 pCi/g
Pb-212	0.54 ± 0.10
Pb-214	0.19 ± 0.18
Ra-226	0.56 ± 0.19
Ac-228	0.79 ± 0.34
Tl-208	0.81 ± 0.22
Bi-214	0.28 ± 0.10
Cs-137	0.90 ± 0.22

Tritium Results:

H-3	0.59 ± 0.11 pCi/g soil

Duplicate Sample of Upper Pit

Sample Type: Soil
Requested: Gamma Isotopic, Tritium (by Azeotropic Distillation)

Gamma Results:

K-40	10.10 ± 0.76 pCi/g
Pb-212	0.73 ± 0.05
Pb-214	0.40 ± 0.10
Ra-226	0.38 ± 0.09
Ac-228	0.77 ± 0.33
Tl-228	0.76 ± 0.10
Bi-214	0.42 ± 0.28
Cs-137	0.94 ± 0.04

Tritium Results:

H-3	0.05 ± 0.02 pCi/g soil

Lower Pit

Sample Type: Soil
Requested: Gamma Isotopic Only

K-40	28.81 ± 1.62 pCi/g
Pb-212	1.90 ± 0.11
Pb-214	1.31 ± 0.27
Ra-226	1.29 ± 0.16
Ac-228	1.62 ± 0.76
Tl-208	1.55 ± 0.19
Bi-214	0.87 ± 0.62
Cs-137	0.93 ± 0.06

Analyses from samples collected in the Old Sodium Burn Pit indicate what are probably normal or background environmental levels of radioactivity for this area. The bismuth, lead, actinium, thallium, radium, and potassium are naturally-occurring radioactive materials. Cesium-137 is found at levels similar to what would be expected at other locations in the United States due to the atmospheric fallout from nuclear weapons testing. One might notice that the Lower Pit gamma levels are roughly twice the Upper Pit. This is to be expected since the Upper Pit samples were counted wet and Lower Pit samples were dry. In addition, the tritium analyses performed on two samples from the upper pit, the original and duplicate, used the azeotropic distillation method. In the case of these two samples, tritium levels are consistent with what would be present naturally and are therefore insignificant.

Leach Field

The Leach Field is the site of a former sewage leach field that had radioactive materials accidentally dumped into it at one time. SSFL had initiated a cleanup that removed soil down to bedrock and then restored the land. Walking surveys with a gamma survey instrument indicated what is probably only background levels of radioactivity. Results of the analysis of the sample collected in this area is below:

Sample Type: Soil
Requested: Gamma Isotopic Only

K-40	31.05 ± 1.27 pCi/g
Pb-212	1.88 ± 0.09
Pb-214	1.11 ± 0.18
Ra-226	1.27 ± 0.13
Ac-228	2.15 ± 0.73
Tl-208	1.58 ± 0.17
Bi-214	1.41 ± 0.53
Cs-137	1.02 ± 0.05

As in the case of the Old Sodium Burn Pit, the isotope levels encountered are representative of natural background.

Building 59, Former Reactor Building

Building 59 was the location of an old test reactor that removed at some time in the past. Walking surveys with a gamma instrument indicated background levels of radiation. Supposedly sand from the area around the building had been contaminated with cobalt-60 and a french drain had been installed in the subfloor to collect infiltrating groundwater. This small quantity of water is pumped to the surface and analyzed. Two separate samples were collected for analysis:

Sample Type: Water
Requested: Tritium

H-3 1890 ± 538 pCi/L

Sample Type: Water
Requested: Gamma Isotopic

Reportable Gamma's NOT DETECTED

There were two findings of interest on these samples. First, that Co-60 or other gamma emitters were not detected, and second, that tritium was. It is evident that from the drainage system set up, that Rocketdyne has successfully prevented Co-60 from getting outside this building. However, tritium was found in a level far above what could be called a background amount and might be attributable to this facility. Rocketdyne previously did not test water for tritium activity. Although the level encountered is orders of magnitude below what could be described as an environmental concern, further study is needed to determine the origin and spread of tritium on the SSFL site.

Trench Near Building 64, SNM Storage Area

Building 64 was described as a Special Nuclear Materials Storage Area. An area around this site was in the process of being cleaned up when samples were collected. This area showed higher than background gamma readings. Two samples were collected, an original and a duplicate, and results are below:

Sample Type: Soil
Requested: Gamma Isotopic Only

K-40	29.33 ± 1.30 pCi/g
Pb-212	1.56 ± 0.15
Pb-214	1.27 ± 0.31
Ra-226	1.25 ± 0.19
Ac-228	1.92 ± 0.27
Tl-208	1.67 ± 0.26
Bi-214	1.49 ± 0.50
Cs-137	331.4 ± 0.6

Duplicate of SNM Sample

Sample Type: Soil
Requested: Gamma Isotopic Only

K-40	31.67 ± 0.96 pCi/g
Pb-212	1.57 ± 0.14
Pb-214	1.32 ± 0.32
Ra-226	1.43 ± 0.18
Ac-228	2.40 ± 1.41
Tl-208	1.67 ± 0.25
Bi-214	1.67 ± 0.25
Cs-137	367.0 ± 0.6

In the case of both samples, all gamma emitters are reasonably consistent with background, with the exception of cesium-137. This is directly attributable to this spill. Rocketdyne was in the process of cleaning up this area when this sample was collected. Further samples should be collected to verify that this cleanup has been completed.

IV. SUMMARY AND CONCLUSIONS

From the samples collected at SSFL, it is evident that contamination exists on site property. From the levels of contamination detected and their location, it is doubtful that contamination has spread offsite. SSFL personnel were apparently unaware of the presence of tritium at Building 59. While not an environmental concern or health risk, the source of this tritium needs to be investigated. It should also be documented that the cesium-137 around Building 64 is brought back to background levels following SSFL cleanup.

In the original report documenting the survey and collection of samples on this site, dated July 28, 1989, it was stressed that certain types of samples were not collected due to time constraints and difficulty of obtaining a contractor laboratory capable of performing those specific analyses required. For a follow-up study, it is first recommended that more water samples be collected and analyzed for tritium. At least a representative group of samples should be analyzed for strontium-90, a beta emitter whose use is known at the site. Since this analysis is difficult in soil, vegetation, and other media, a contractor laboratory must be chosen carefully. It is also recommended that vegetation and other media, specifically samples from feral species be collected and analyzed as warranted.

The Office of Radiation Programs - Las Vegas Facility has presented the Region 9 Office in San Francisco a proposal to assist the region and state in their efforts to bring the SSFL investigation to a close and allay questions that have arisen concerning the SSFL environmental program.