Formerly Utilized Sites Remedial
Action Program (FUSRAP)

Maywood Chemical Company Superfund Site

ADMINISTRATIVE RECORD

Document Number

MISS- 117.

US Army Corps
of Engineers®

M-733

ORNL/RASA-88/18

HEALTH AND SAFETY RESEARCH DIVISION

Waste Management Research and Development Programs
(Activity No. AH 10 05 00 0; NEAH001)

RESULTS OF THE RADIOLOGICAL SURVEY AT 72 SIDNEY STREET, LODI, NEW JERSEY (LJ067)

R. D. Foley, R. F. Carrier, L. M. Floyd, and J. W. Crutcher

Date Published - September 1989

Investigation Team

R. E. Swaja - Measurement Applications and Development Manager
W. D. Cottrell - FUSRAP Project Director
R. W. Doane - Field Survey Supervisor*

*Former employee of Martin Marietta Energy Systems

Survey Team Members

A. C. Butler
W. H. Shinpaugh†
J. K. Williams

†Stone Associates

Work performed by the
MEASUREMENT APPLICATIONS AND DEVELOPMENT GROUP

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U. S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

064475

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

The Division of Facility and Site Decommissioning Projects, U. S. Department of Energy, sponsored the research for this project under contract DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc. The authors wish to acknowledge the support of J. E. Baublitz, acting Director, Office of Remedial Action and Waste Technology; J. J. Fiore, Director, Division of Facility and Site Decommissioning Projects; and members of their staffs. The authors also appreciate the contributions of B. C. Littleton and L. J. Jeffers of IR&A Publications Office, and thank the following individuals of the Measurement Applications and Development Group of the Health and Safety Research Division for participation in the collection, analysis, and reporting of data for this survey. for their participation in the collection, analyses, and reporting of data for this survey: A. C. Butler, D. A. Roberts, T. R. Stewart, and J. K. Williams. Finally, we gratefully acknowledge the assistance of W. H. Shinpaugh of Don Stone, Associates.

ABSTRACT

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid–1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the U.S. Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 72 Sidney Street, Lodi, New Jersey (LJ067), was conducted during 1987.

Results indicated concentrations of ^{232}Th slightly in excess of the DOE remedial action criterion for subsurface soil. This finding, coupled with the fact that adjacent properties have been designated by DOE for remedial action, and that the old Lodi Brook streambed is apparently beneath the property, suggests that it be considered for inclusion in the DOE remedial action program.

RESULTS OF THE RADIOLOGICAL SURVEY AT 72 SIDNEY STREET LODI, NEW JERSEY (LJ067)*

INTRODUCTION

From 1916 to 1956, process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores were generated by the Maywood Chemical Works (MCW), Maywood, New Jersey. During the latter part of this period, MCW supplied rare earth metals and thorium compounds to various government agencies. In the 1940s and 1950s, MCW produced thorium and lithium, under contract, for the Atomic Energy Commission (AEC). These activities ceased in 1956, and approximately three years later, the 30-acre real estate was purchased by the Stepan Company. The property is located at 100 Hunter Avenue in a highly developed area in Maywood and Rochelle Park, Bergen County, New Jersey.

During the early years of operation, MCW stored wastes and residues in low-lying areas west of the processing facilities. In the early 1930s, these areas were separated from the rest of the property by the construction of New Jersey State Highway 17. The Stepan property, the interim storage facility, and several vicinity properties have been designated for remedial action by the Department of Energy (DOE).

The waste produced by the thorium extraction process was a sandlike material containing residual amounts of thorium and its decay products, with smaller quantities of uranium and its decay products. During the years 1928 and 1944 to 1946, area residents used these process wastes mixed with tea and cocoa leaves as mulch in their lawns and gardens. In addition, some of the contaminated wastes were apparently eroded from the site into Lodi Brook and carried downstream.

Lodi Brook is a small stream flowing south from Maywood with its headwaters near the Stepan waste storage site. Approximately 150 ft after passing under State Route 17, the stream has been diverted underground through concrete or steel culverts until it merges with the Saddle River in Lodi, New Jersey. Only a small section near Interstate 80 remains uncovered. From the 1940s to the 1970s when the stream was being diverted underground, its course was altered several times. Some of these changes resulted in the movement of contaminated soil to the surface of a few properties, where it is still in evidence. In other instances, the contaminated soil was covered over or mixed with clean fill, leaving no

*The survey was performed by members of the Measurement Applications and Development group of the Health and Safety Research Division at Oak Ridge National Laboratory under U. S. DOE contract DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc.

immediate evidence on the surface. Therefore, properties in question may be drilled in search of former stream bed material, even in the absence of surface contamination.

As a result of the Energy and Water Appropriations Act of Fiscal Year 1984, the property discussed in this report and others in its vicinity contaminated with residues from the former MCW, were included as a decontamination research and development project under the DOE Formerly Utilized Sites Remedial Action Program. As part of this project, DOE is conducting radiological surveys in the vicinity of the site to identify properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological survey discussed in this report is part of that effort and was conducted, at the request of DOE, by members of the Measurement Applications and Development Group of the Oak Ridge National Laboratory.

A radiological survey of the fenced, vacant lot at 72 Sidney Street, Lodi, New Jersey, was conducted during 1987. The survey and sampling of the ground surface, as well as the subsurface investigation, were carried out on June 6, 1987.

SURVEY METHODS

The radiological survey included: (1) a gamma scan of the entire property outdoors, (2) collection of subsurface soil samples, and (3) gamma profiles of auger holes. No indoor survey measurements were performed. The survey methods followed the plan outlined in Reference 1. A comprehensive description of the survey methods and instrumentation has been presented in another report.[2]

Using a portable gamma scintillation meter, ranges of measurements were recorded for areas of the property surface. To define the extent of possible subsurface soil contamination, auger holes were drilled to depths of approximately 2.6 m. A plastic pipe was placed in each hole, and a NaI scintillation probe was lowered inside the pipe. The probe was encased in a lead shield with a horizontal row of collimating slits on the side. This collimation allows measurement of gamma radiation intensities resulting from contamination within small fractions of the hole depth. If the gamma readings in the hole were elevated, a soil sample was scraped from the wall of the auger hole at the point showing the highest gamma radiation level. The auger hole loggings were used to select locations where further soil sampling would be useful. A split-spoon sampler was used to collect subsurface samples at known depths. In some auger holes, a combination of split-spoon sampling and side-wall scraping was used to collect samples.

SURVEY RESULTS

Applicable federal guidelines are summarized in Table 1.[3] Normal background radiation levels for the northern New Jersey area are presented in Table 2. These data are provided for comparison with survey results presented in this section. All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in environmental samples.

Surface Gamma Radiation Levels

Gamma radiation levels measured during a scan of the surface of the property are given in Fig. 1. Gamma exposure rates over the property ranged from 3 to 9 μR/h.

Auger Hole Soil Samples and Gamma Logging

Varying thicknesses of subsurface soil were sampled from depths of 75 to 255 cm in auger holes (A) drilled at seven separate locations as indicated in Fig. 2, except for A5 and A6, which were not sampled due to the absence of elevated gamma activity. The results of analyses of these samples are given in Table 3 (A1A-A7F). Concentrations of ^{226}Ra and ^{232}Th in soil samples from five auger holes ranged from 0.42 to 4.3 pCi/g and 0.36 to 16 pCi/g, respectively. The concentrations of ^{232}Th in samples A1C and A4D (16 pCi/g) exceeds the DOE criterion for subsurface soil (Table 1). The elevated concentrations were found at depths between 105 and 150 cm. The maximum concentration of ^{226}Ra, 4.3 pCi/g, was higher than the typical background level of 0.9 pCi/g but well below the guideline.

Gamma logging was performed in each of the seven auger holes to characterize and further define the extent of possible contamination. The logging technique used here is not radionuclide specific. However, logging data, in conjunction with soil analyses data, may be used to estimate regions of elevated radionuclide concentrations in auger holes when compared with background levels for the area. Following a comparison of these data, it appears that any shielded scintillator readings of 1,000 counts per minute (cpm) or greater generally indicate the presence of elevated concentrations of ^{226}Ra and/or ^{232}Th. Data from the gamma profiles of the logged auger holes are graphically represented in Figs. 3 through 9. Readings at depths between 0.75 and 1.8 m were greater than 1,000 cpm in auger hole 1, with a maximum reading of 3,700 cpm at 1 m. Readings in auger hole 2 were elevated only at 1.7 m, with a maximum of 1,100 cpm. In hole 3, elevated readings were between 0.75 and 1.2 m, with a maximum of 1,600 cpm at 0.9 m. Gamma levels were above 1,000 cpm at 0.9 to 1.7 m beneath the surface in hole 4 where the maximum was 1,700 cpm at 1.4 m. No readings above 800 cpm were found in holes 5 or 6. Finally, elevated

readings in hole 7 were measured between 0.9 and 1.5 m, with a maximum of 1,500 cpm at 1 m. In general, the areas of highest gamma readings correspond to the greatest concentrations of radionuclides shown in Table 3.

SIGNIFICANCE OF FINDINGS

Measurements taken at 72 Sidney Street indicate that the property may contain a small amount of radioactive contamination. The concentration of ^{232}Th (the major contaminant from processing operations at the MCW) on this property at sampling locations A1 and A4 was slightly in excess of the DOE criterion for subsurface soil (Table 1). Therefore, because it is strongly indicated that the old streambed underlies this property, and because adjacent properties have been designated by DOE for remedial action, it is recommended that the property at 72 Sidney Street be considered for inclusion in the DOE remedial action program.

REFERENCES

1. W. D. Cottrell, ORNL, to A. J. Whitman, DOE/HQ, correspondence, "Radiological Survey of Private Properties in Lodi, New Jersey" (August 15, 1984).

2. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program,* Oak Ridge National Laboratory, ORNL/TM-8600 (April 1987).

3. U. S. Department of Energy, *Guidelines for Residual Radioactivity at Formerly Utilized Sites, Remedial Action Program and Remote Surplus Facilities Management Program Sites* (Rev. 2, March 1987).

4. T. E. Myrick and B. A. Berven, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979,* Oak Ridge National Laboratory, ORNL/TM-7343 (November 1981).

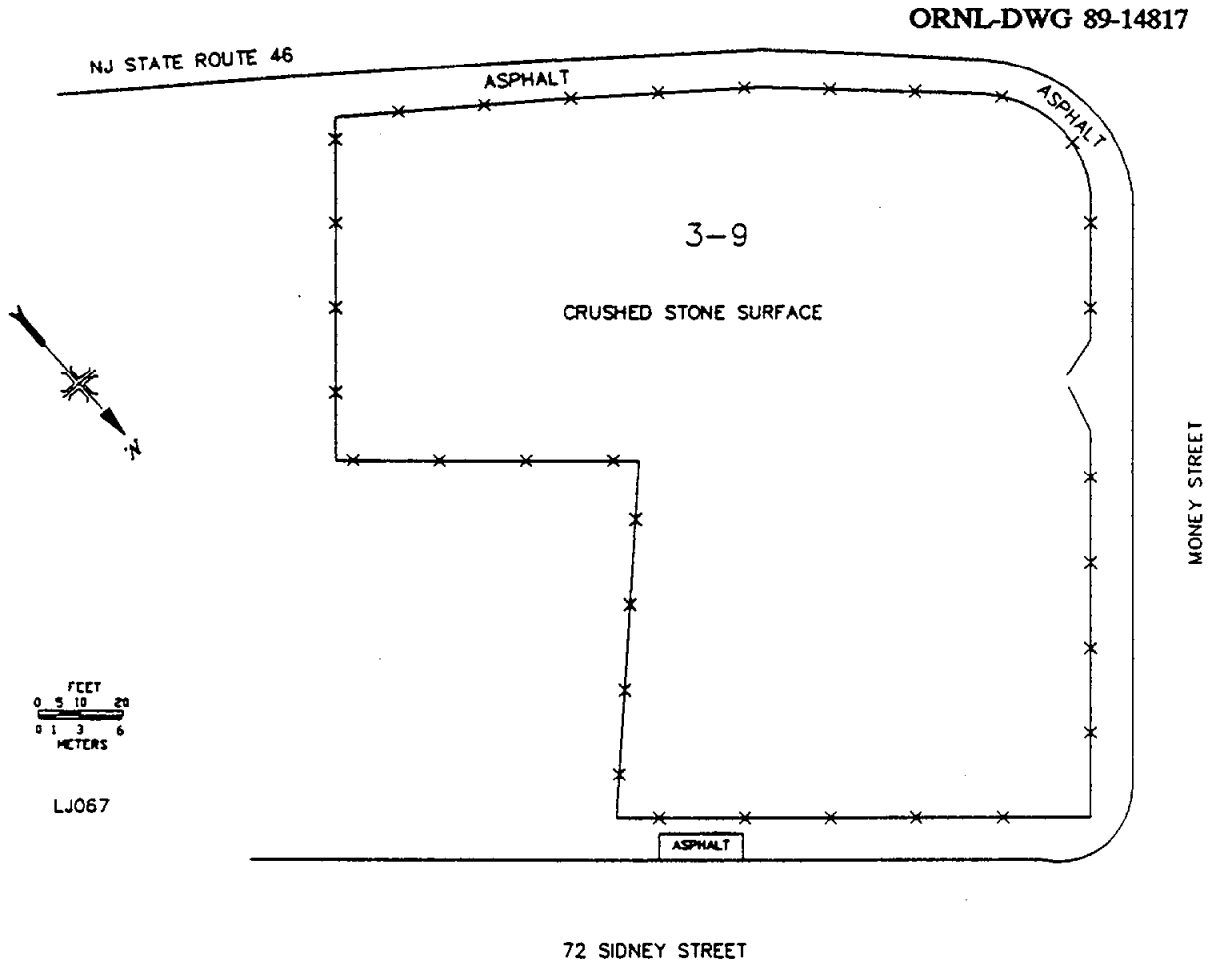

Fig. 1. Gamma radiation levels (μR/h) measured on the surface at 72 Sidney Street, Lodi, New Jersey (LJ067).

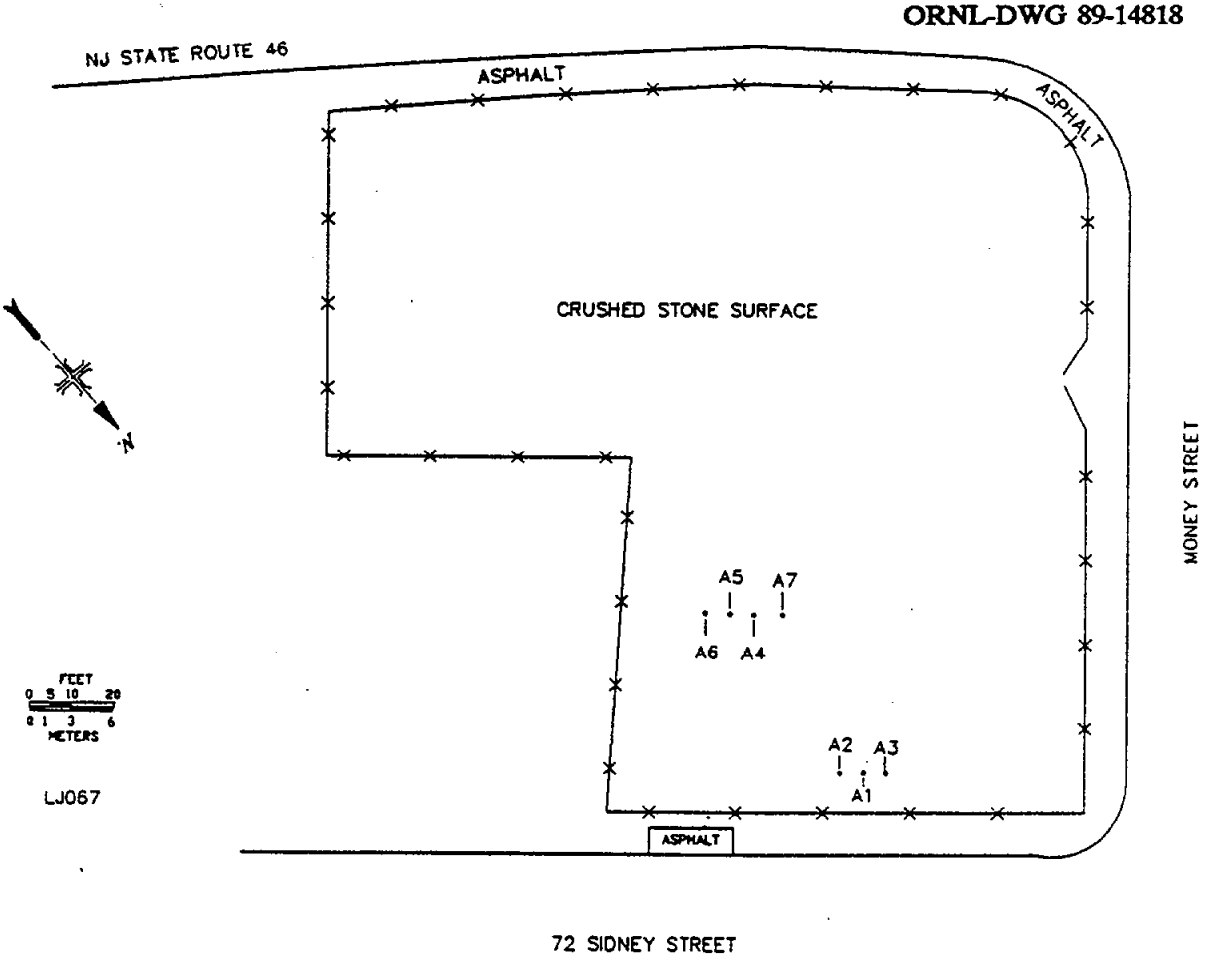

Fig. 2. Diagram showing locations of soil samples taken at 72 Sidney Street, Lodi, New Jersey (LJ067).

ORNL-DWG 89-14819

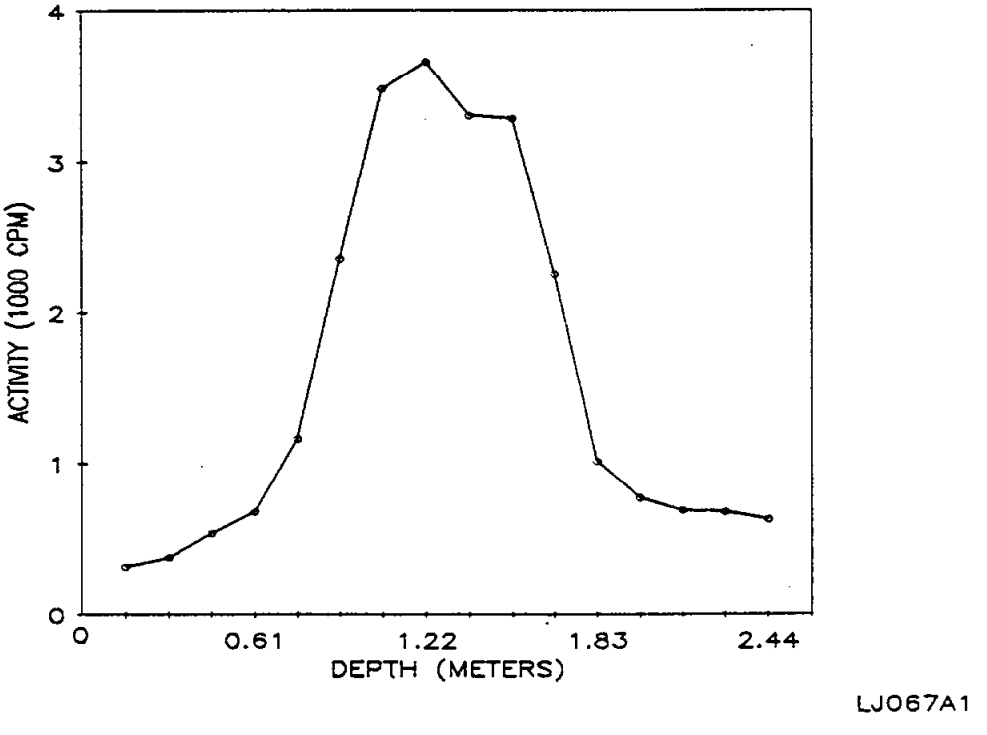

Fig. 3. Gamma profile for auger hole 1 (A1) at 72 Sidney Street, Lodi, New Jersey.

ORNL-DWG 89-14820

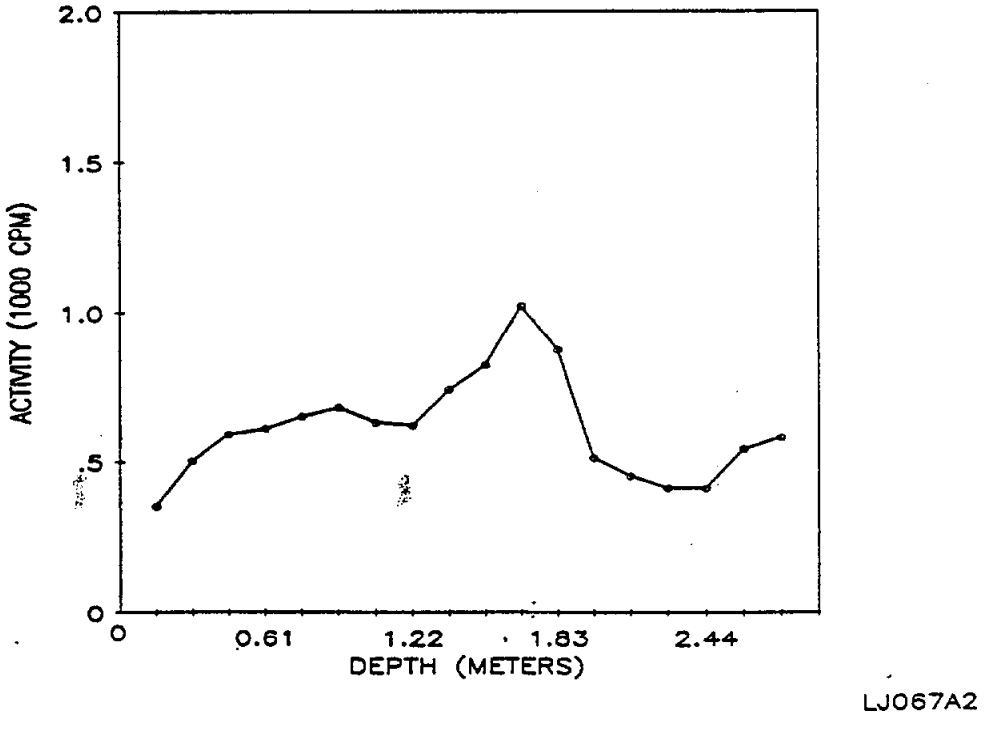

Fig. 4. Gamma profile for auger hole 2 (A2) at 72 Sidney Street, Lodi, New Jersey.

ORNL-DWG 89-14821

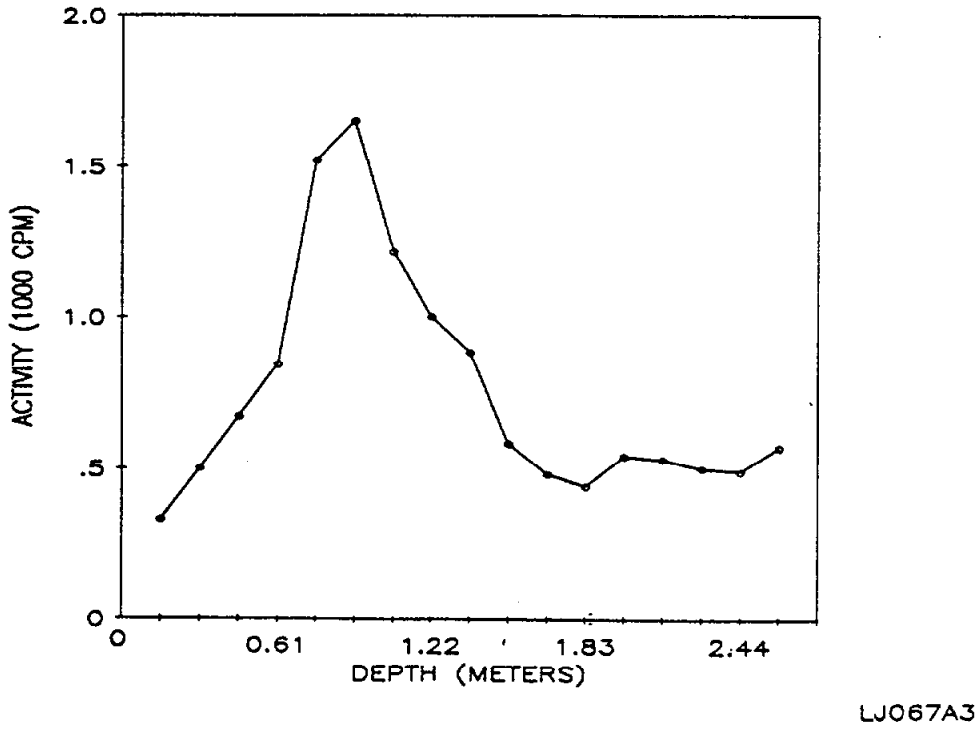

Fig. 5. Gamma profile for auger hole 3 (A3) at 72 Sidney Street, Lodi, New Jersey.

ORNL-DWG 89-14822

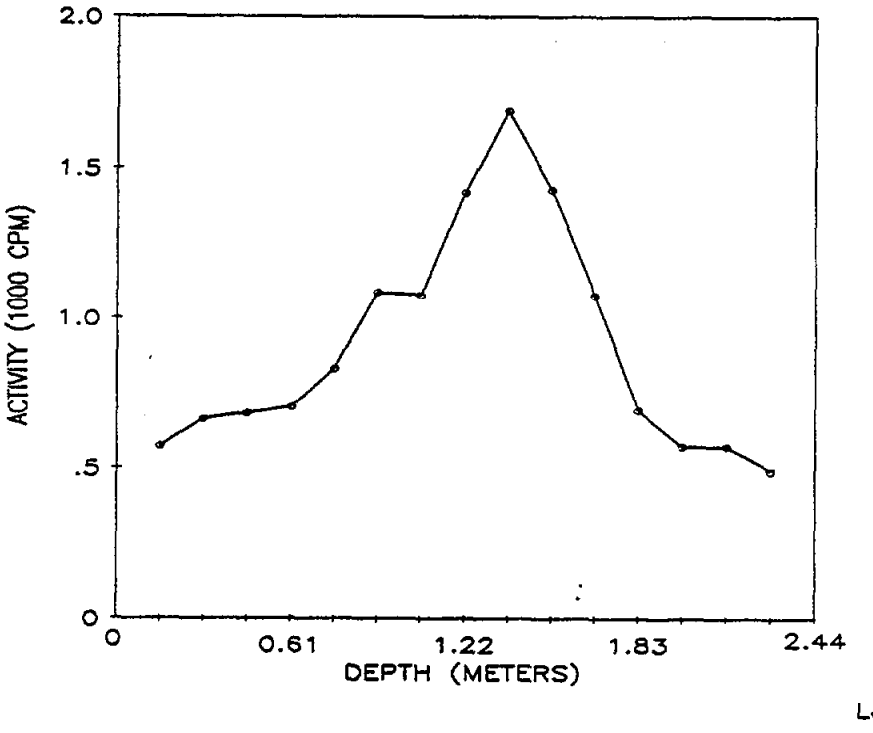

Fig. 7. Gamma profile for auger hole 4 (A4) at 72 Sidney Street, Lodi, New Jersey.

ORNL-DWG 89-14823

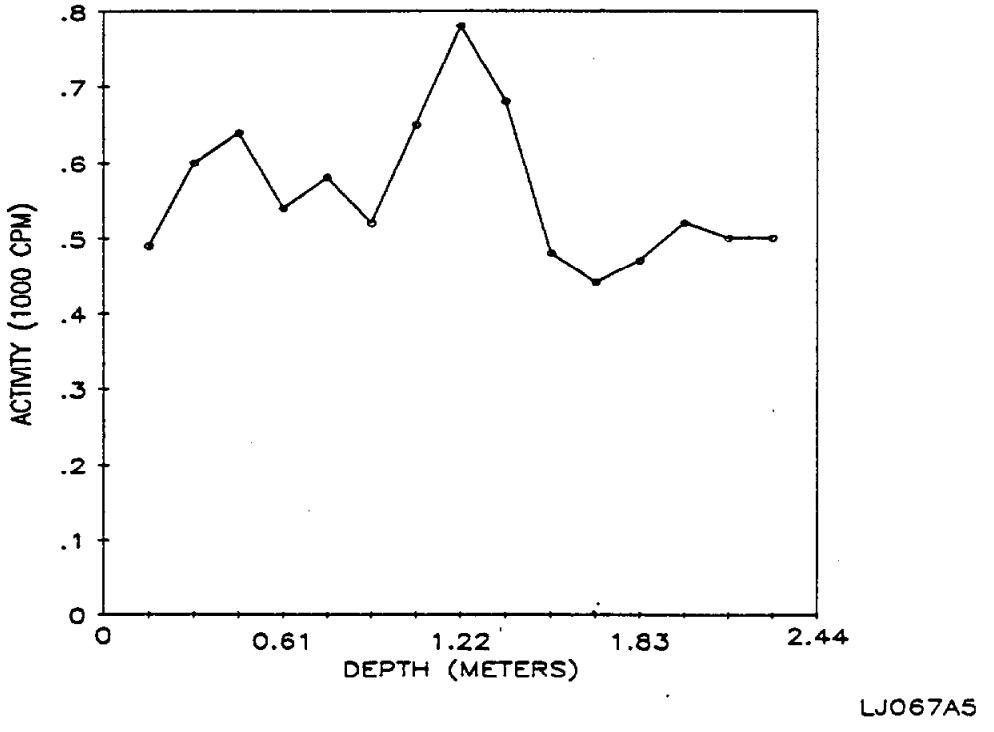

Fig. 8. Gamma profile for auger hole 5 (A5) at 72 Sidney Street, Lodi, New Jersey.

ORNL-DWG 89-14824

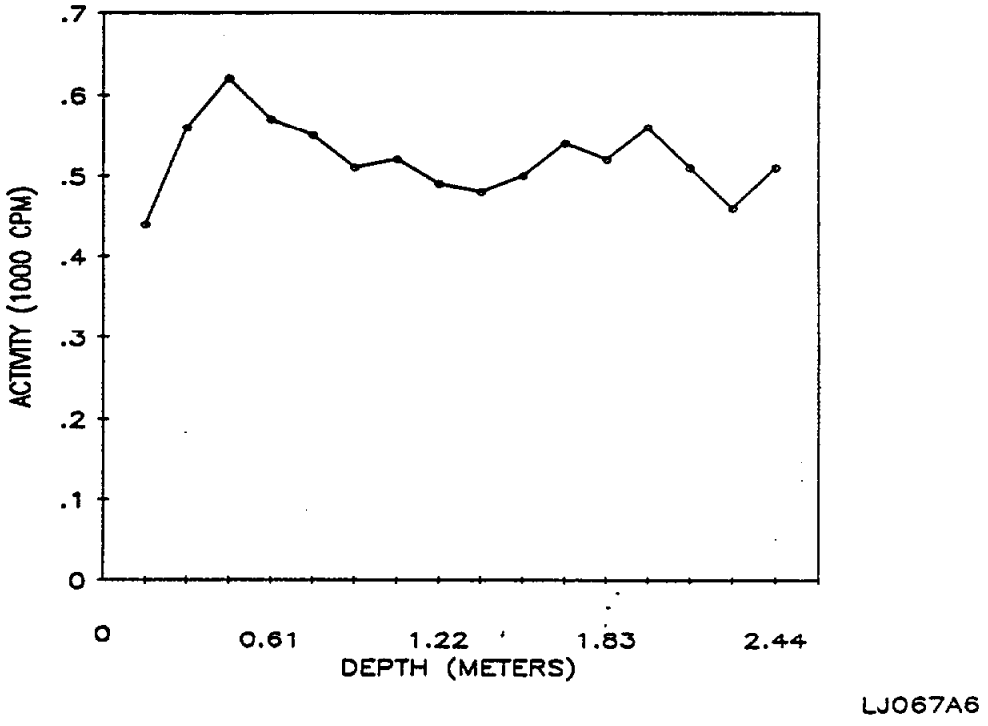

Fig. 9. Gamma profile for auger hole 6 (A6) at 72 Sidney Street, Lodi, New Jersey.

ORNL-DWG 89-14825

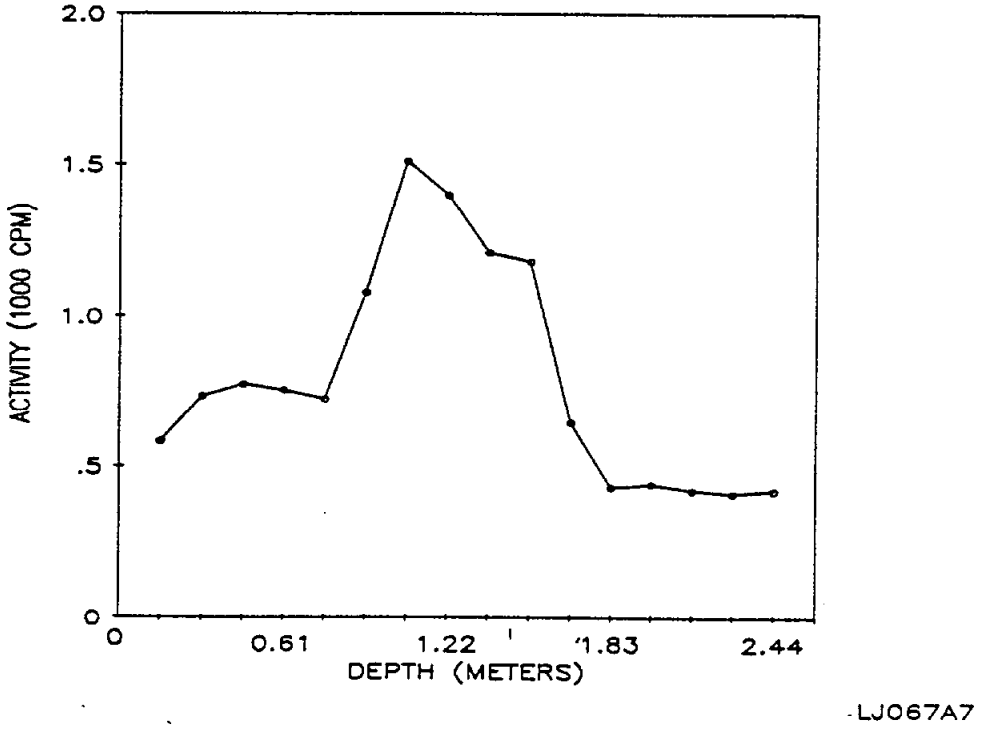

Fig. 5. Gamma profile for auger hole 7 (A7) at 72 Sidney Street, Lodi, New Jersey.

Table 1. Applicable guidelines for protection against radiation[a]

Mode of exposure	Exposure conditions	Guideline value
Radionuclide concentrations in soil	Maximum permissible concentration of the following radionuclides in soil above background levels averaged over a 100 m^2 area ^{232}Th ^{230}Th ^{228}Ra ^{226}Ra	5 pCi/g averaged over the first 15-cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface

[a]U. S. Department of Energy, *Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* (Rev. 2, March 1987).

Table 2. Background radiation levels for the northern New Jersey area

Type of sample	Radionuclide concentration
Concentration of radionuclides in soil (pCi/g)[a]	
^{137}Cs	0.9
^{226}Ra	0.9
^{238}U	0.9

[a]Reference 4.

Table 3. Concentrations of radionuclides in soil at 72 Sidney Street, Lodi, New Jersey (LJ067)

Sample[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
		^{226}Ra[b]	^{232}Th[b]
		Auger samples[c]	
A1A	75–90	0.65 ± 0.2	1.3 ± 0.04
A1B	90–105	1.4 ± 0.1	11 ± 0.2
A1C	105–120	2.6 ± 1	16 ± 0.8
A1D	120–135	2.4 ± 0.4	8.7 ± 1.0
A1E	135–150	4.3 ± 0.4	9.3 ± 0.7
A1F	165–185	1.6 ± 0.2	4.9 ± 1.0
A1G	185–195	0.54 ± 0.04	0.51 ± 0.05
A1H	195–215	0.42 ± 0.03	0.46 ± 0.1
A1I	215–225	0.67 ± 0.09	0.75 ± 0.3
A1J	225–245	0.54 ± 0.04	0.55 ± 0.6
A1K	245–255	0.47 ± 0.09	0.57 ± 0.2
A2A	75–90	0.49 ± 0.1	0.69 ± 0.2
A2B	90–105	0.74 ± 0.06	0.96 ± 0.06
A2C	120–135	0.60 ± 0.1	0.94 ± 0.2
A2D	135–150	0.73 ± 0.09	1.8 ± 0.2
A2E	150–165	0.71 ± 0.01	1.3 ± 0.09
A2F	165–185	2.0 ± 0.3	7.3 ± 0.3
A2G	185–195	0.81 ± 0.1	1.0 ± 0.3
A2H	195–215	0.50 ± 0.08	0.61 ± 0.1
A2I	215–225	1.3 ± 0.2	6.6 ± 0.7
A2J	225–245	0.73 ± 0.1	1.5 ± 0.3
A2K	245–255	0.50 ± 0.1	0.64 ± 0.2
A3A	75–90	0.93 ± 0.06	4.7 ± 0.4
A3B	90–105	1.4 ± 0.4	5.1 ± 0.4
A3C	105–120	1.1 ± 0.1	2.7 ± 0.1
A3D	120–135	1.2 ± 0.2	2.0 ± 0.2
A3E	135–150	0.72 ± 0.03	0.56 ± 0.2
A3F	150–165	0.57 ± 0.1	0.36 ± 0.08
A3G	165–185	0.54 ± 0.07	0.55 ± 0.07
A3H	185–195	0.58 ± 0.04	0.52 ± 0.1
A3I	195–215	0.48 ± 0.06	0.51 ± 0.2
A3J	215–225	0.58 ± 0.02	0.54 ± 0.06
A3K	225–245	0.49 ± 0.09	0.53 ± 0.09
A3L	245–255	0.48 ± 0.05	0.62 ± 0.1

Table 3 (continued)

Sample[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
		^{226}Ra[b]	^{232}Th[b]
		Auger samples[c]	
A4A	75–90	1.2 ±0.09	1.1 ±0.3
A4B	90–105	0.88 ± 0.05	1.4 ±0.09
A4C	No sample		
A4D	135–150	1.8 ±0.4	16 ±0.5
A4E	165–185	1.9 ±0.3	8.1 ±0.4
A4F	185–195	0.83 ± 0.06	0.69 ± 0.2
A4G	195–215	0.42 ± 0.04	0.54 ± 0.1
A4H	215–225	0.88 ± 0.09	3.4 ±0.4
A4I	225–245	0.50 ± 0.07	0.90 ± 0.1
A4J	245–255	0.45 ± 0.03	0.45 ± 0.4
A5	No samples		
A6	No samples		
A7A	75–90	1.2 ±0.1	4.3 ±0.1
A7B	90–105	0.64 ± 0.1	1.4 ±0.1
A7C	105–120	2.3 ±0.06	9.1 ±0.6
A7D	120–135	1.6 ±0.1	2.6 ±0.7
A7E	135–150	2.2 ±0.09	14
A7F	150–165	0.89 ± 0.04	1.3 ±0.2

[a]Locations of soil samples are shown on Fig. 2.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Auger samples are taken from holes drilled to further define the depth and extent of radioactive material. Holes are drilled where the surface may or may not be contaminated.

INTERNAL DISTRIBUTION

1. B. A. Berven
2. R. F. Carrier
3. W. D. Cottrell
4. A. G. Croff
5. J. W. Crutcher
6. L. M. Floyd
7–11. R. D. Foley
12. S. V. Kaye
13. P. Y. Lu
14. P. T. Owen
15–17. R. E. Swaja
18. J. K. Williams
19. Central Research Library
20. IR&A Publications Office
21. Laboratory Records – RC
22. Y-12 Technical Library

EXTERNAL DISTRIBUTION

23. J. D. Berger, Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, TN 37831
24. R. W. Doane, Eberline, Inc., 800 Oak Ridge Turnpike, P.O. Box 350, Oak Ridge, Tn 37831
25. J. J. Fiore, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874
26–28. G. K. Hovey, Bechtel National, Inc., 800 Oak Ridge Turnpike, P.O. Box 350, Oak Ridge, TN 37831
29. L. R. Levis, Roy F. Weston, Inc., 20030 Century Blvd., Germantown, MD 20874
30. G. P. Turi, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874
31. J. W. Wagoner, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874
32–34. Andrew Wallo III, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874
35. Office of Assistant Manager, Energy Research and Development, Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831–8600
36–37. Office of Scientific and Technical Information, DOE, P.O. Box 62, Oak Ridge, TN 37831