Formerly Utilized Sites Remedial
Action Program (FUSRAP)

Maywood Chemical Company Superfund Site

ADMINISTRATIVE RECORD

Document Number

MISS- 116.

US Army Corps
of Engineers®

M-728

ORNL/RASA--88/51

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 THE NATIONAL COMMUNITY BANK, 113 ESSEX STREET, MAYWOOD, NEW JERSEY (MJ021)

R. D. Foley, W. D. Cottrell, and L. M. Floyd

Date Published — September 1989

Investigation Team

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

Survey Team Members

A. C. Butler*
C. A. Muhr
J. A. Rice†
W. Winton

*Former Employee of Martin Marietta Energy Systems, Inc.
†Oak Ridge Associated Universities

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

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

Research for this project was sponsored by the Division of Facility and Site Decommissioning Projects, U.S. Department of Energy, under Contract No. DE-AC05-84O-R21400 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 J. L. Rich, S. W. Hawthorne, and L. J. Jeffers of the Publications Division; M. S. Uziel of the Environmental Information Systems Group; and T. R. Stewart of the Measurement Applications and Development Group; A. C. Butler, former employee of Martin Marietta Energy Systems, Inc.; P. M. Guerin of Wentworth Institute of Technology; and W. H. Shinpaugh of Don Stone Associates for participation in the collection, analyses, editing, and reporting of data for this survey.

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, the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021), was conducted during 1986.

Results of the survey demonstrated radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions are typical of the type of material originating from the MCW site.

RESULTS OF THE RADIOLOGICAL SURVEY AT THE NATIONAL COMMUNITY BANK, 113 ESSEX STREET, MAYWOOD, NEW JERSEY (MJ021)*

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 immediate evidence on the surface. Therefore, properties in question may be drilled in search of former streambed 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 properties 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

---

*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 DOE contract DE-AC05-84OR21400.

properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological surveys discussed in this report are part of that effort and were 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 commercial property at the National Community Bank, 113 Essex Street, Maywood, New Jersey, was conducted in 1986. The survey and sampling of the ground surface were carried out on November 19-20, 1986.

Before the bank was built in the mid–1960s, the contaminated Lodi Brook crossed the property in four 24–inch concrete pipes underground (Fig. 1). Presently, it crosses the bank property in a new concrete box culvert a few feet southeast of the original easement. From the original point of entry to the property at State Route 17, the new easement parallels the southeast wall of the building until it reaches the front lawn, where it angles back to the original easement and goes under Essex Street.

It could not be determined whether the previous easement drainage had been located in the original streambed. Nevertheless, movement of soil during installation of the original four pipes, and again during relocation of the stream to the new culvert, could have spread contamination over a large portion of this property. Determining the limits of the contamination may require extensive drilling because the site is now covered with asphalt.

SURVEY METHODS

The radiological survey of the property included: (1) a gamma scan of the entire property surface outdoors and (2) collection of soil samples. No indoor survey measurements were performed. The survey methods followed the basic plan outlined in a correspondence from W. D. Cottrell to A. J. Whitman.[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 gamma exposure rates were recorded for areas of the property surface. Biased soil samples were collected in areas of elevated gamma levels; though, not all elevated areas were sampled. The biased locations were sampled to depths of approximately 45 cm for an initial examination of possible subsurface soil contamination. Measurements were usually made and soil samples collected at 15–cm intervals. The samples were analyzed for ^{226}Ra, ^{232}Th, and ^{238}U content.

SURVEY RESULTS

Applicable federal guidelines are summarized in Table 1.[3] The normal background radiation levels for the New Jersey area are presented in Table 2.[4,5] 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 soil samples.

Surface Gamma Radiation Levels

Gamma radiation levels measured during a gamma scan of the property surface are given in Fig. 1. Gamma exposure rates over the major portion of the property ranged from 5 to 12 μR/h. The highest measurements ranged from 11 to 25 μR/h and were found in front of the building on either side of the steps. Soil samples B1 and B2 were taken from this area. Elevated gamma levels were also evident along the eastern boundary of the

property, measuring from 11 to 19 μR/h. Soil samples B3 and B4 were taken in this area.

Biased Soil Samples

Biased soil samples were taken from various locations on the property for radionuclide analyses. Locations of these samples (B) are shown in Fig. 2, with results of laboratory analyses provided in Table 3. Concentrations of radium, thorium, and uranium in these samples ranged from 1.0 to 2.0 pCi/g, 1.5 to 8.5 pCi/g, and 0.98 to 3.1 pCi/g, respectively. All samples were near or above background levels for the northern New Jersey area (Table 2). Thorium levels in biased soil samples B1A and B2A were 8.5 pCi/g and 6.5 pCi/g, respectively; both of these concentrations were in excess of DOE criteria (Table 1).

SIGNIFICANCE OF FINDINGS

Measurements and results of soil sample analyses taken at the National Community Bank indicate that the property contained radioactive contamination primarily from the ^{232}Th decay chain, with slight contamination from both ^{226}Ra and ^{238}U. These radionuclide distributions are typical of the type of material originating from the processing operations at the MCW site. The concentration and extent of ^{232}Th on this property is in excess of the applicable DOE criteria (Table 1). This material was found at sample locations B1 and B2, as shown in Fig. 2. Based on the results of this radiological assessment, it is recommended that this site 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 Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* (Rev. 2, March 1987).

4. U.S. Department of Energy, *Radiological Survey of the Middelsex Municipal Landfill, Middlesex, New Jersey*, DOE/EV-00005/20 (April 1980).

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

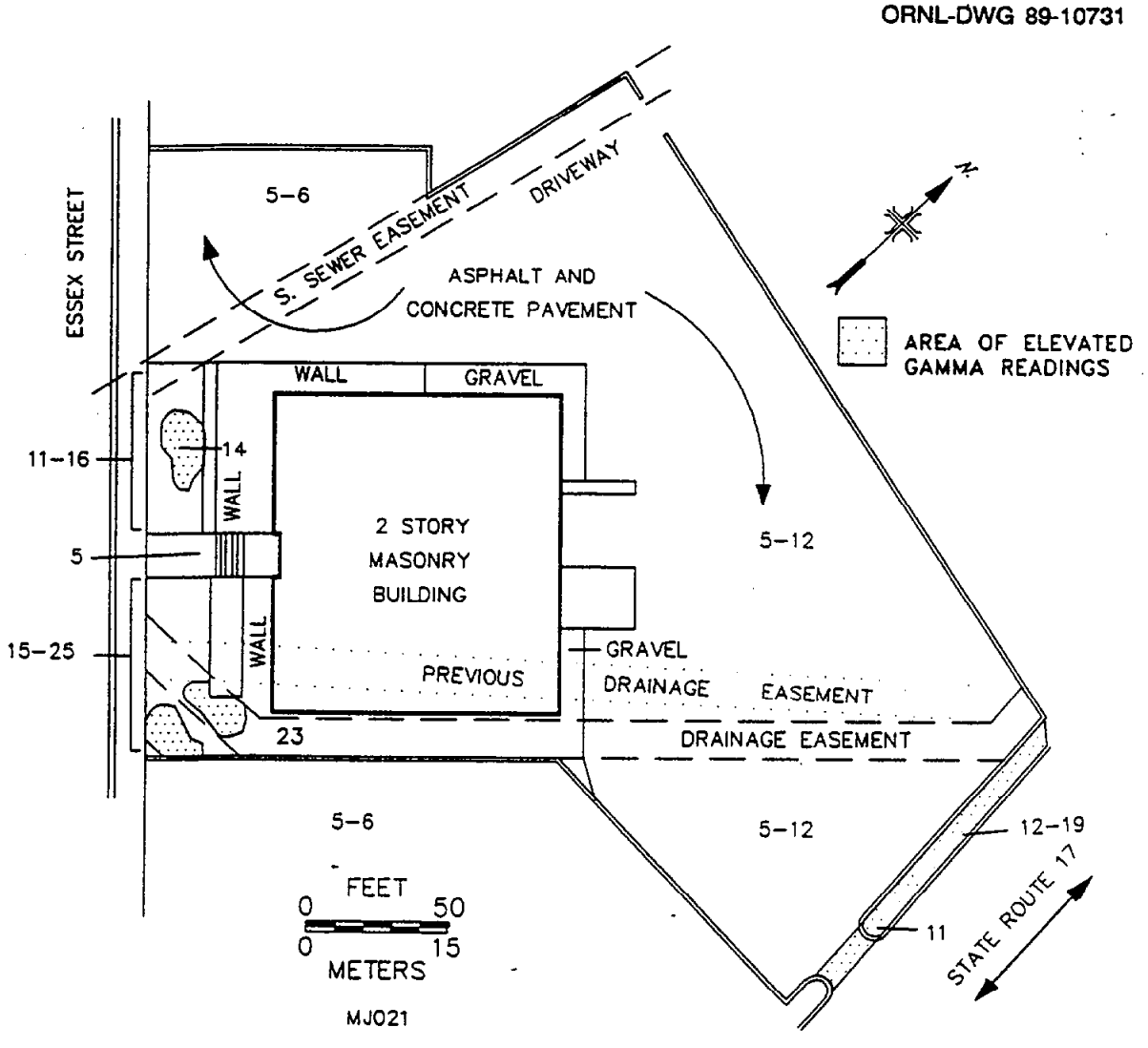

Fig. 1. Gamma radiation levels (μR/h) measured on the surface at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021).

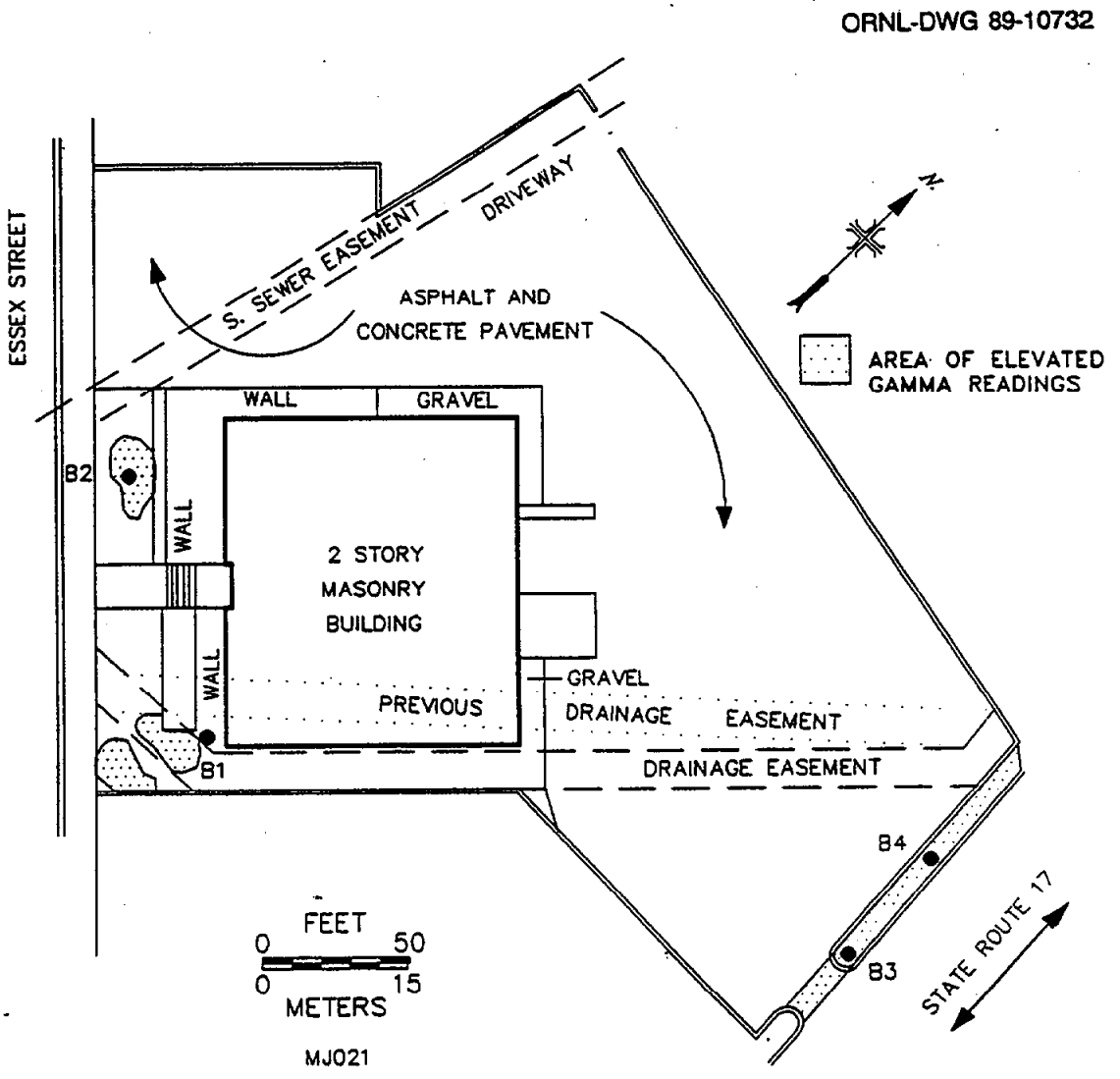

Fig. 2. Diagram showing locations of soil samples taken at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021).

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 100 m^2 area	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
	^{232}Th	
	^{230}Th	
	^{228}Ra	
	^{226}Ra	
	^{238}U	Derived (site specific)

[a]Reference 3.

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

Type of radiation measurement or sample	Radiation level or radionuclide concentration[a]
Gamma exposure at 1 m above ground surface (μR/h)	8[b]
Concentration of radionuclides in soil (pCi/g)	
^{226}Ra	0.9[c]
^{232}Th	0.9[c]
^{238}U	0.9[c]

[a]These values represent an average of normal radionuclide concentrations in this part of the state. Actual values may fluctuate.

[b]Reference 4.

[c]Reference 3.

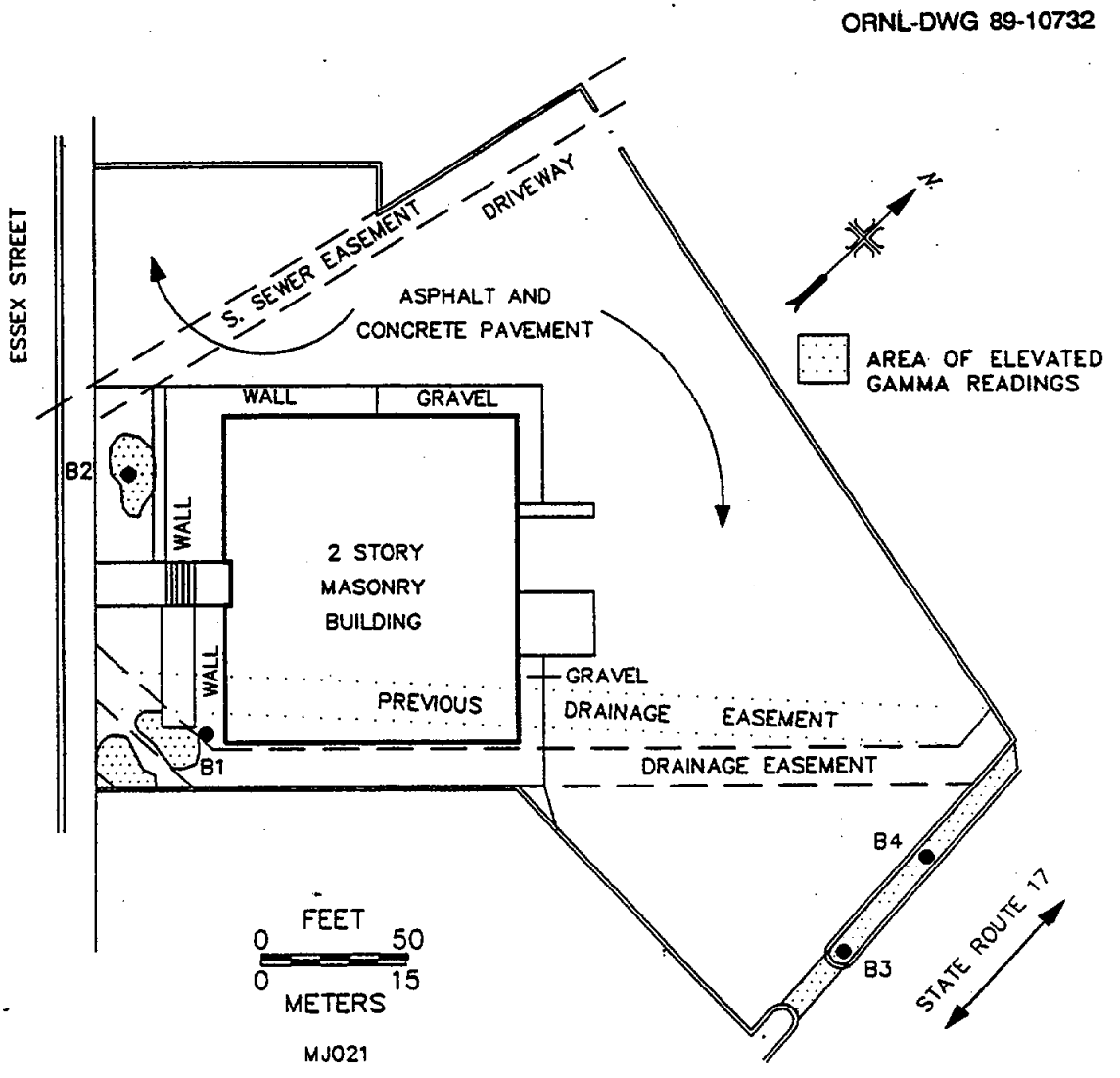

Fig. 2. Diagram showing locations of soil samples taken at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021).

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 100 m^2 area	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
	^{232}Th	
	^{230}Th	
	^{228}Ra	
	^{226}Ra	
	^{238}U	Derived (site specific)

[a]Reference 3.

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

Type of radiation measurement or sample	Radiation level or radionuclide concentration[a]
Gamma exposure at 1 m above ground surface (μR/h)	8[b]
Concentration of radionuclides in soil (pCi/g)	
^{226}Ra	0.9[c]
^{232}Th	0.9[c]
^{238}U	0.9[c]

[a]These values represent an average of normal radionuclide concentrations in this part of the state. Actual values may fluctuate.

[b]Reference 4.

[c]Reference 3.

Table 3. Concentrations of radionuclides in soil at the National Community Bank, 113 Essex Street, Maywood, New Jersey (MJ021)

Sample[a]	Depth (cm)	Radionuclide concentration (pCi/g)		
		^{226}Ra[b]	^{232}Th[b]	^{238}U[c]
		Biased samples[d]		
B1A	0–15	2.0±0.2	8.5±0.8	3.1
B1B	15–30	1.8±0.1	6.5±0.6	2.1
B2A	0–15	1.7±0.06	6.5±0.7	2.9
B2B	15–30	1.5±0.09	4.4±0.1	1.9
B3A	0–15	1.4±0.06	1.5±0.2	0.98
B3B	15–30	1.3±0.1	1.6±0.2	1.2
B3C	30–45	1.1±0.05	2.0±0.2	1.1
B4A	0–15	1.3±0.05	4.9±0.3	2.2
B4B	15–30	1.3±0.04	2.9±0.2	1.3
B4C	30–45	1.0±0.09	2.3±0.4	1.2

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

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

[c]Total analytical error of measurement results is less than ±5% (95% confidence level).

[d]Biased samples are taken from areas with elevated gamma exposure rates.

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