

LEGIBILITY NOTICE

A major purpose of the Technical Information Center is to provide the broadest dissemination possible of information contained in DOE's Research and Development Reports to business, industry, the academic community, and federal, state and local governments.

Although a small portion of this report is not reproducible, it is being made available to expedite the availability of information on the research discussed herein.

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 ROUTE 17(S) AND BECKER AVENUE,
ROCHELLE PARK, NEW JERSEY
(RJ001)**

R. D. Foley and R. F. Carrier

Date Published - November 1989

Investigation Team

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

Survey Team Members

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

***D. R. Stone, Associates, Inc.**

**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**

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

ps

CONTENTS

LIST OF FIGURES	v
LIST OF TABLES	v
ACKNOWLEDGMENTS	vii
ABSTRACT	ix
INTRODUCTION	1
SURVEY METHODS	2
SURVEY RESULTS	2
Surface Gamma Radiation Levels	3
Systematic and Biased Soil Samples	3
SIGNIFICANCE OF FINDINGS	3
REFERENCES	4

LIST OF FIGURES

- 1 Gamma radiation levels ($\mu\text{R/h}$) measured on the surface at Route 17(S) and Becker Avenue, Rochelle Park, New Jersey (RJ001) 5
- 2 Diagram showing location of soil sample taken at Route 17(S) and Becker Avenue, Rochelle Park, New Jersey (RJ001) 6

LIST OF TABLES

- 1 Applicable guidelines for protection against radiation 7
- 2 Background radiation levels for the northern New Jersey area 7
- 3 Concentrations of radionuclides in soil at Route 17(S) & Becker Avenue, Rochelle Park, New Jersey (RJ001) 8

ACKNOWLEDGMENTS

Research for this project was sponsored by the U. S. Department of Energy's Division of Facility and Site Decommissioning Projects, 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 D. A. Roberts, T. R. Stewart, and W. Winton of the Measurement Applications and Development Group; J. A. Rice of the Grand Junction Office; and A. C. Butler of D. R. Stone & Associates, Inc. for their 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 surveys typically include direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this commercial property at Route 17(S) and Becker Avenue, Rochelle Park, New Jersey (RJ001), was conducted in 1986.

Measurements taken at the commercial property located at Route 17(S) and Becker Avenue indicate slightly elevated gamma exposure rates in three areas of the parking lot. Although results of analysis of the asphalt disclosed radionuclide concentrations in excess of the applicable criterion, their presence is due to naturally radioactive substances in asphalt patching materials and is not associated with material from the MCW site. Therefore, it is recommended that this site be eliminated from consideration for inclusion in the DOE remedial action program.

**RESULTS OF THE RADIOLOGICAL SURVEY AT ROUTE 17 &
BECKER AVENUE, ROCHELLE PARK, NEW JERSEY
(RJ001)***

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

*Members of the Measurement Applications and Development Group of the Health and Safety Research Division at Oak Ridge National Laboratory performed the survey under DOE contract DE-AC05-84OR21-400.

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 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 properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological survey discussed in this report was 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 commercial property at Route 17(S) and Becker Avenue, Rochelle Park, New Jersey, was conducted on November 19, 1986.

SURVEY METHODS

The radiological survey included a gamma scan of the entire property outdoors and collection of surface and subsurface 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 measurements were recorded for areas of the property surface. Samples of asphalt, as well as surface and subsurface soil were collected in order to characterize and define the extent of contamination.

SURVEY RESULTS

Applicable federal guidelines are summarized in Table 1.³ Typical background radiation levels for the Maywood, 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

Radiation levels measured during a gamma scan of the surface of the property are given in Fig. 1. Gamma exposure rates over the major portion of the property ranged from 4 to 10 $\mu\text{R/h}$, values approximating background for the northern New Jersey area. Elevated gamma levels ranging from 17 to 21 $\mu\text{R/h}$ were measured at three newly asphalted areas of the parking lot located along Route 17. The particular type of asphalt used in paving and patching the lot has been used in other locations in the Rochelle Park/Maywood area where it was also found to have elevated gamma exposure rates. The fill aggregate is thought to contain naturally occurring radionuclides responsible for the slight elevations observed. The three areas total approximately 170 m^2 .

Biased Soil and Asphalt Samples

Four biased (B) samples were taken from varying depths at one location of elevated gamma levels for radionuclide analyses. One sample (B1A) was asphalt from the surface of the patching; three samples were soil. The sampling location is shown in Fig. 2 with results of laboratory analyses provided in Table 3.

Concentrations of radium and thorium in the soil samples approximated background levels for the northern New Jersey area (Table 2), ranging from 0.61 to ~ 0.65 pCi/g and 0.75 to 0.96 pCi/g , respectively. Uranium-238 concentrations in samples B1B, B1C, and B1D were also low at 0.67 to 0.94 pCi/g . Radium-226, ^{232}Th , and ^{238}U concentrations in the asphalt sample were above background at 2.6, 4.8, and 4.5 pCi/g , confirming that the elevated gamma levels resulted from substances present in the patching material. When ^{226}Ra and ^{232}Th values from the asphalt are combined, the resulting concentration of 7.4 pCi/g exceeds the DOE criterion for the surface when considered over the 170 m^2 area of anomalous gamma readings.

SIGNIFICANCE OF FINDINGS

Measurements taken at the commercial property located at Route 17(S) and Becker Avenue indicate that slightly elevated gamma exposure rates observed in three areas of the parking lot result from naturally radioactive substances in asphalt patching materials and are not associated with material from the MCW site. Although the combined ^{232}Th and ^{226}Ra concentrations in a sample of the asphalt exceed the applicable DOE criterion (Table 1), it is recommended that this site be eliminated from consideration 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 Middlesex Municipal Landfill, Middlesex, New Jersey* DOE/EV-0005/20 (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).

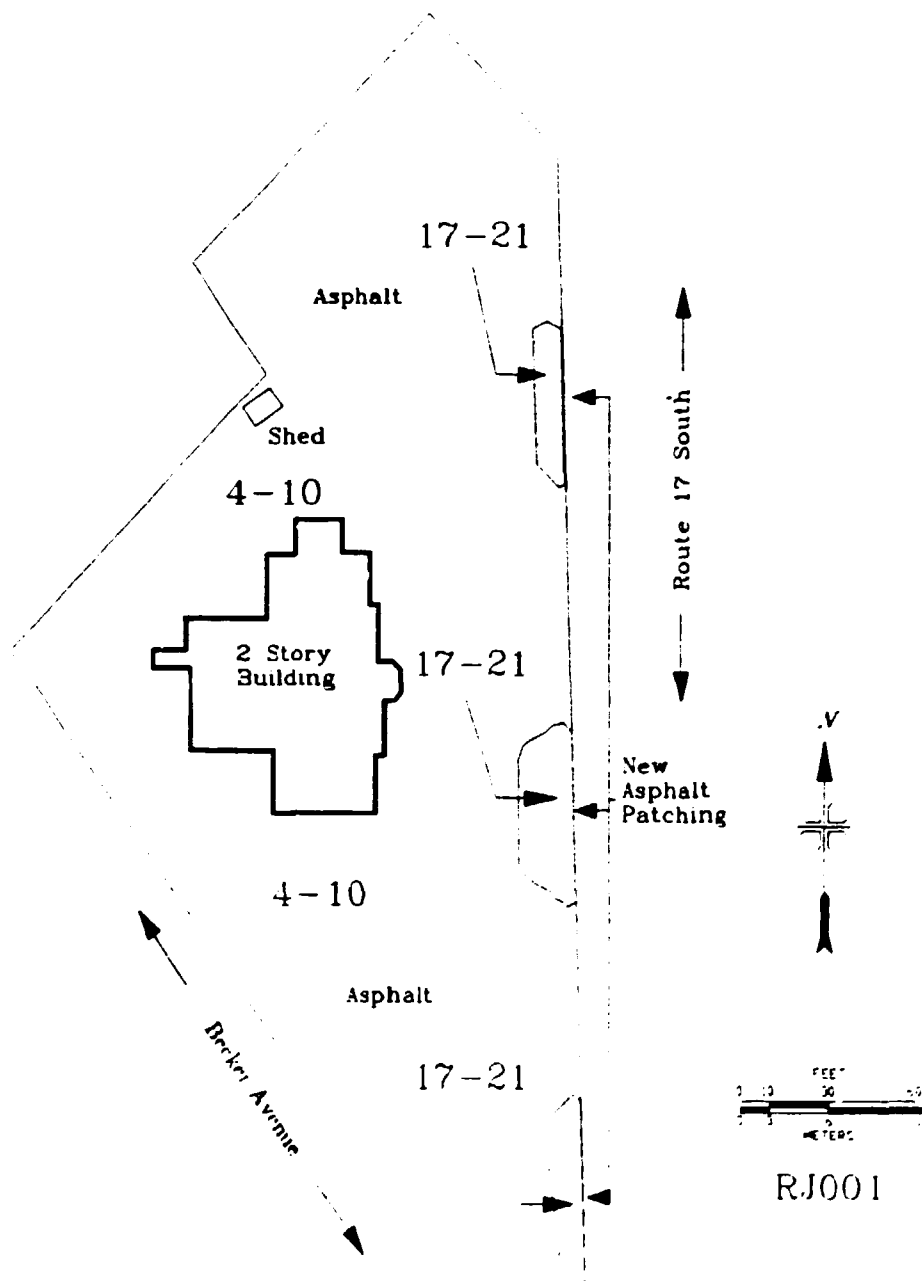


Fig. 1. Gamma radiation levels ($\mu\text{R/h}$) measured on the surface at Route 17(S) and Becker Avenue, Rochelle Park, New Jersey (RJ001).

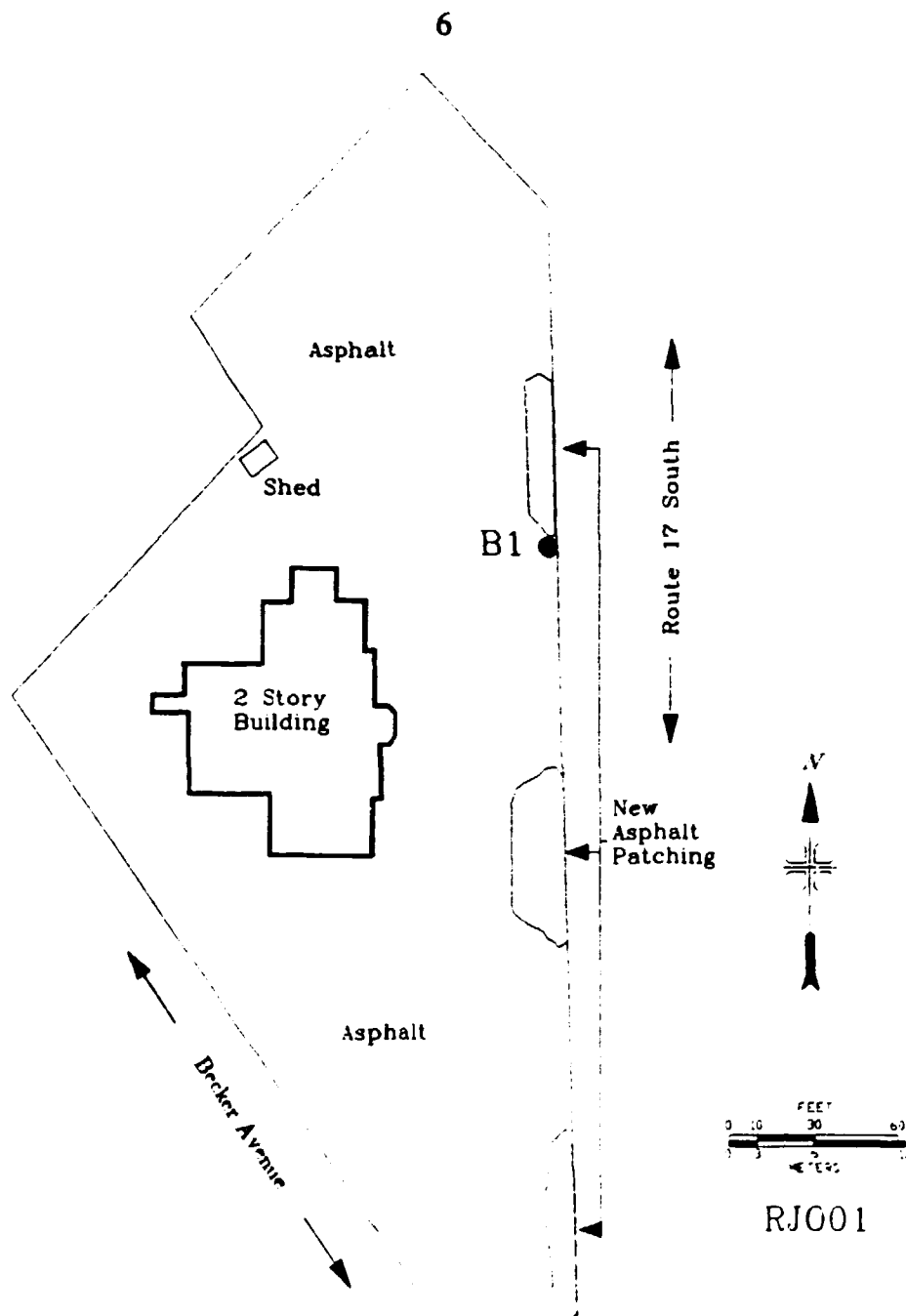


Fig. 2 Diagram showing location of soil sample taken at Route 17(S) and Becker Avenue, Rockville Park, New Jersey (RJ001).

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 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

^aReference 3.

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

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

^aReference 4.^bReference 5.

**Table 3. Concentrations of radionuclides in soil at Route 17
& Becker Avenue, New Rochelle, New Jersey (RJ001)**

Biased sample ^a	Depth (cm)	Radionuclide concentration (pCi/g)		
		²²⁶ Ra ^b	²³² Th ^b	²³⁸ U ^b
B1A	0-5	2.6 ±0.2	4.8 ±0.4	4.5
B1B	0-15	0.61±0.05	0.75±0.08	0.71
B1C	15-30	0.65±0.06	0.96±0.21	0.67
B1D	30-45	0.61±0.05	0.82±0.10	0.94

^aLocation of soil sample is shown on Fig. 2. Biased samples are taken from areas shown to have elevated gamma exposure rates.

^bIndicated counting error is at the 95% confidence level ($\pm 2 \sigma$).

^cTotal analytical error of measurement results is less than $\pm 5\%$ (95% confidence level).