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**RESULTS OF THE RADIOLOGICAL SURVEY
AT STATE ROUTE 17 & BECKER AVENUE,
MAYWOOD, NEW JERSEY (MJ033)**

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CONTENTS

LIST OF FIGURES	v
LIST OF TABLES	v
ACKNOWLEDGEMENTS	vii
ABSTRACT	ix
INTRODUCTION	1
SURVEY METHODS	2
SURVEY RESULTS	2
Surface Gamma Radiation Levels	2
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 State Route 17 & Becker Avenue, Maywood, New Jersey (MJ033) 5
- 2 Diagram showing locations of soil samples taken at State Route 17 & Becker Avenue, Maywood, New Jersey (MJ033) 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 State Route 17 & Becker Avenue, Maywood, New Jersey (MJ033) 8

v/v i

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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 survey 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 at State Route 17 and Becker Avenue, Maywood, New Jersey (NJ033), was conducted during 1987.

Survey measurements indicate that no radiological measurements were in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. Slightly elevated radiation measurements were found in association with three concrete areas adjacent to the highway. However, these levels were typical of those found on concrete. Such construction materials frequently contain naturally radioactive substances that may enhance the background radiation. In any case, the radionuclide distributions were not significantly different from those in the northern New Jersey area.

RESULTS OF THE RADIOLOGICAL SURVEY AT STATE ROUTE 17 & BECKER AVENUE, MAYWOOD, NEW JERSEY (MJ033)*

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 stream bed material, even in the absence of surface contamination.

*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.

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 is part of that effort and was conducted, at the request of DOE, by members of the Measurements Applications and Development Group of the Oak Ridge National Laboratory.

A radiological survey of the commercial property at the intersection of State Route 17 and Becker Avenue, Maywood, New Jersey, was conducted on June 10, 1987.

SURVEY METHODS

The radiological survey included a gamma scan of the entire property outdoors and the collection of surface soil samples. No indoor survey measurements were performed.

Using a portable gamma scintillation meter, ranges of measurements were recorded for areas of the property surface. In addition, systematic soil samples were obtained at randomly selected locations irrespective of gamma exposure rates. 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

SURVEY RESULTS

Applicable federal guidelines are summarized in Table 1.³ The 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

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 5 to 12 $\mu\text{R/h}$. These values are near the typical background value of 8 $\mu\text{R/h}$ (Table 2). Elevated gamma levels ranging from 12 to 19 $\mu\text{R/h}$ were measured in three concrete areas adjacent to Highway 17. Construction materials such as concrete often contain naturally radioactive substances which may exhibit slightly elevated gamma exposure rates. These anomalies do not appear to be related to the MCW site.

Systematic and Biased Soil Samples

Two systematic (S) soil samples were taken from depths of 0 to 15 cm at two different locations on the property. Sampling locations are shown in Fig. 2 with results of radionuclide analyses provided in Table 3. Concentrations of radium and thorium in these samples were 0.57 and 0.46 pCi/g and 0.68 and 0.62 pCi/g, respectively. All samples were below typical background values encountered in the northern New Jersey area (Table 2).

SIGNIFICANCE OF FINDINGS

Slightly elevated gamma exposure rates measured in three concrete areas on the property are typical of construction materials containing naturally enhanced levels of radioactivity. No radiological measurements taken on the property at the intersection of State Highway 17 and Becker Avenue were in excess of DOE criteria for inclusion in the remedial action program. Based on the results of this radiological assessment, it is recommended that this site be eliminated from consideration for inclusion in that effort.

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).
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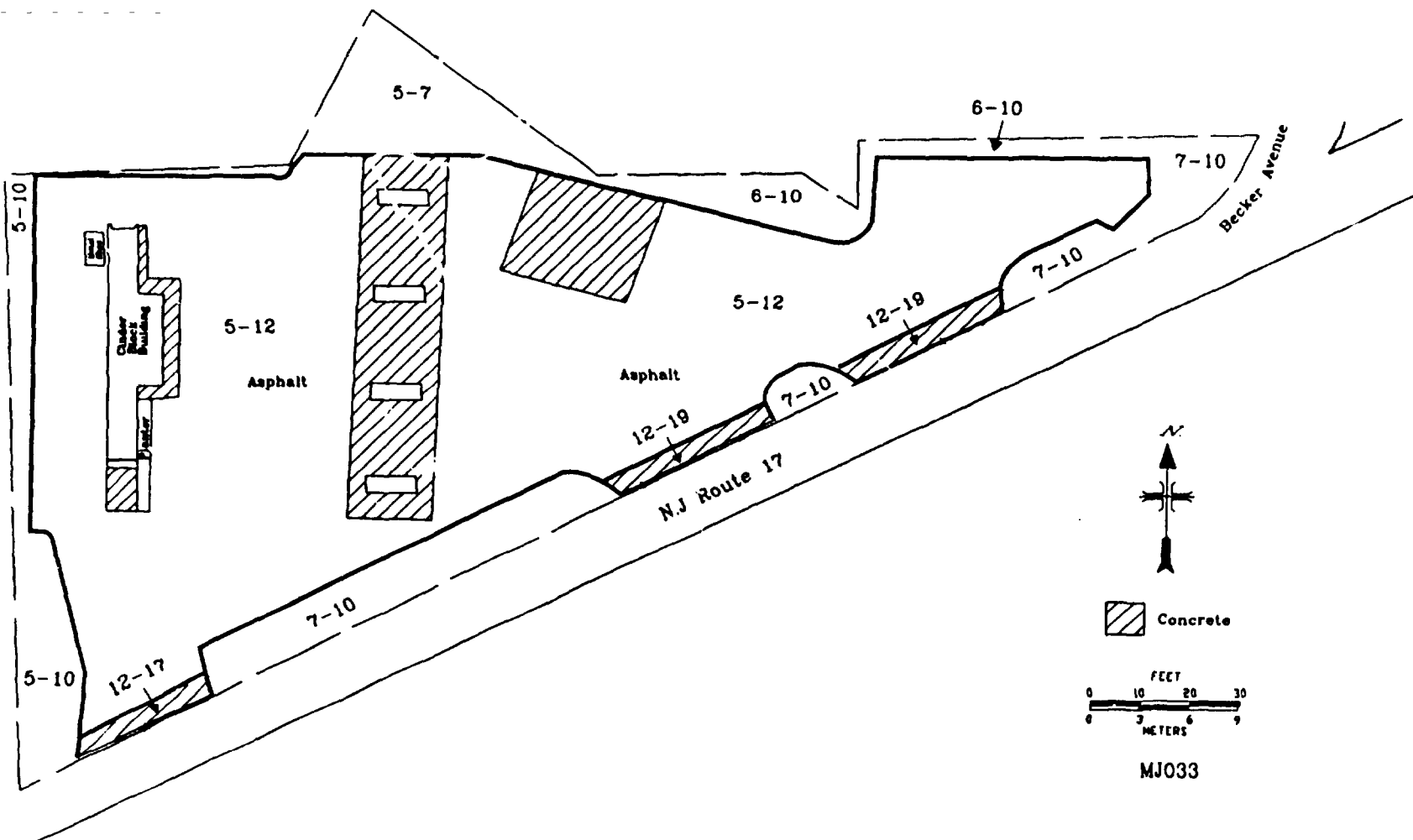


Fig. 1. Gamma radiation levels ($\mu\text{R/h}$) measured on the surface at State Route 17 & Becker Avenue, Maywood, New Jersey (MJ033).

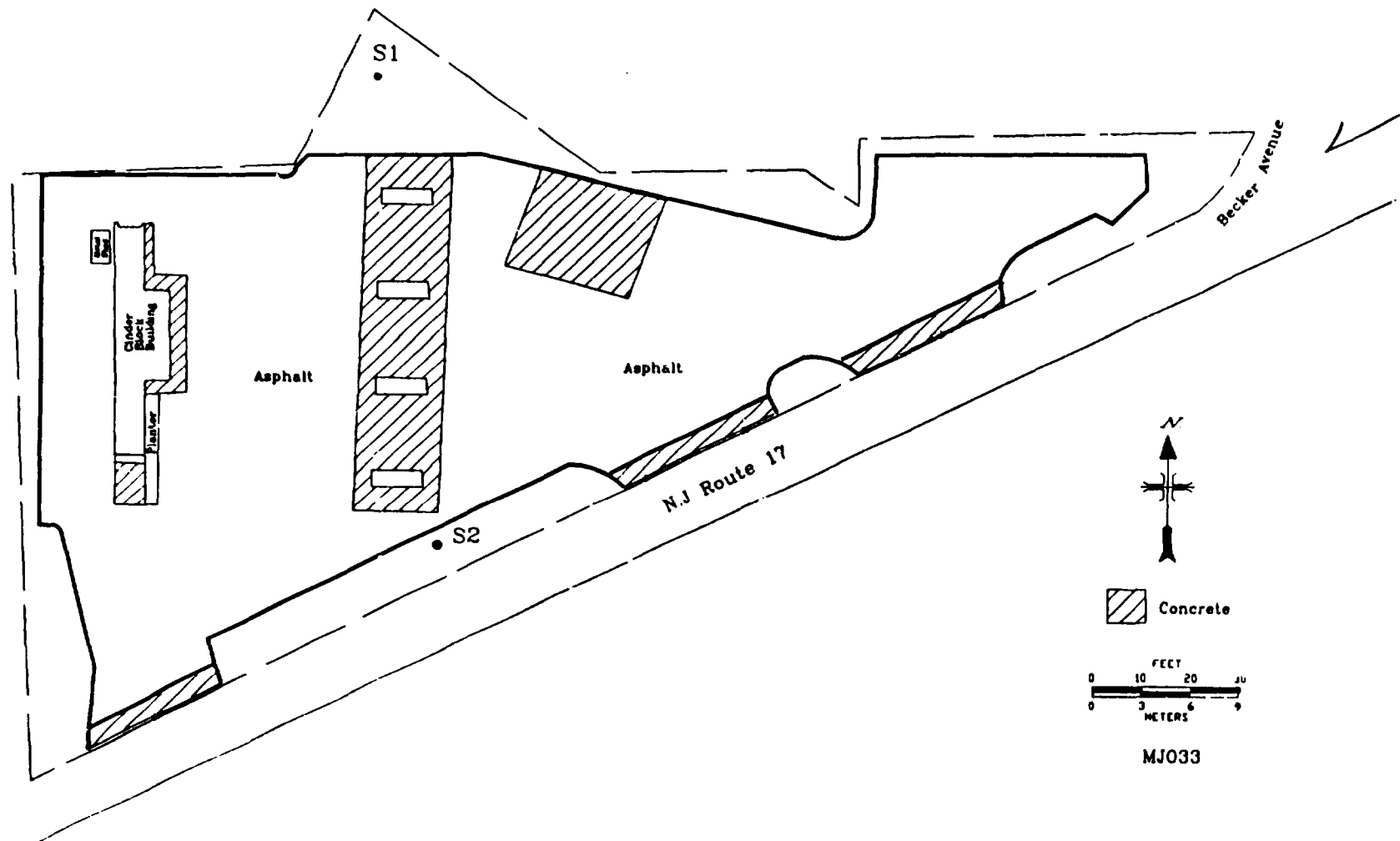


Fig. 2. Diagram showing locations of soil samples taken at State Route 17 & Becker Avenue, Maywood, New Jersey (MJ033).

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 State Route 17 and Becker Avenue, Maywood, New Jersey (MJ033)

Sample ^a	Depth (cm)	Radionuclide concentration (pCi/g)	
		²²⁶ Ra ^b	²³² Th ^b
S1	0-15	0.57±0.04	0.68±0.07
S2	0-15	0.46±0.09	0.62±0.2

^aLocations of soil samples are shown on Fig. 2.

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

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