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Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

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RESULTS OF THE RADIOLOGICAL SURVEY AT 88 EAST CENTRAL AVENUE, MAYWOOD, NEW JERSEY (MJ037)

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HEALTH AND SAFETY RESEARCH DIVISION

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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 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, 88 East Central Avenue Maywood, New Jersey (MJ037), was conducted during 1988.

Results of the survey indicated radioactivity in the range of normal background for the northern New Jersey area. Radiological assessments of soil samples from the site demonstrate no radionuclide concentrations in excess of DOE Formerly Utilized Sites Remedial Action Program criteria.

RESULTS OF THE RADIOLOGICAL SURVEY AT 88 EAST CENTRAL AVENUE, MAYWOOD, NEW JERSEY (MJ037)*

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.

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 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 group of Oak Ridge National Laboratory.

A radiological survey of the private, residential property at 88 East Central Avenue, Maywood, New Jersey, was conducted during 1988. The survey and sampling of the ground surface and subsurface were carried out on May 2, 1988.

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*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.

SURVEY METHODS

The radiological survey of the property included: (1) a surface gamma scan of the entire property outdoors and (2) collection of surface and subsurface soil samples. The survey methods followed the plan outlined in Reference 1. No indoor survey measurements were performed.

Using a portable gamma scintillation meter, ranges of measurements were recorded for areas of the property surface. If the gamma measurements were elevated, a biased soil sample was taken at the point showing the highest gamma radiation level. Systematic soil samples were taken at various locations on the property, irrespective of gamma radiation levels. 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.

Gamma Radiation Levels

Gamma 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 11 μR/h. Higher measurements were observed around the drip line from the roof (14 μR/h) and on the brick corners of the front of the house (15 μR/h). The difference in exposure rates measured over the major portion of the property and those measured near the brick corners of the house may result from the small amounts of naturally occurring radioactive substances in the raw materials used to make bricks.

Systematic and Biased Soil Samples

Systematic and biased soil samples were taken from various locations on the property for radionuclide analyses. Locations of the systematic (S) and biased (B) samples are shown in Fig. 2, with results of laboratory analyses provided in Table 3. Concentrations of ^{226}Ra and ^{232}Th in these samples ranged from 0.74 to 1.0 pCi/g and from 0.87 to 1.0 pCi/g, respectively. These values are well within applicable DOE guidelines (Table 1). Determinable values for concentrations of ^{238}U ranged from 1.2 to 1.4 pCi/g. Radionuclide concentrations are below to slightly above normal background levels for the northern New Jersey area (Table 2).

SIGNIFICANCE OF FINDINGS

Measurements taken at 88 East Central Avenue indicate radioactivity in the range of normal background for the northern New Jersey area. Radiological assessments of soil samples from the site demonstrate no radionuclide concentrations in excess of applicable DOE guidelines.

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ORNL-DWG 89-12311

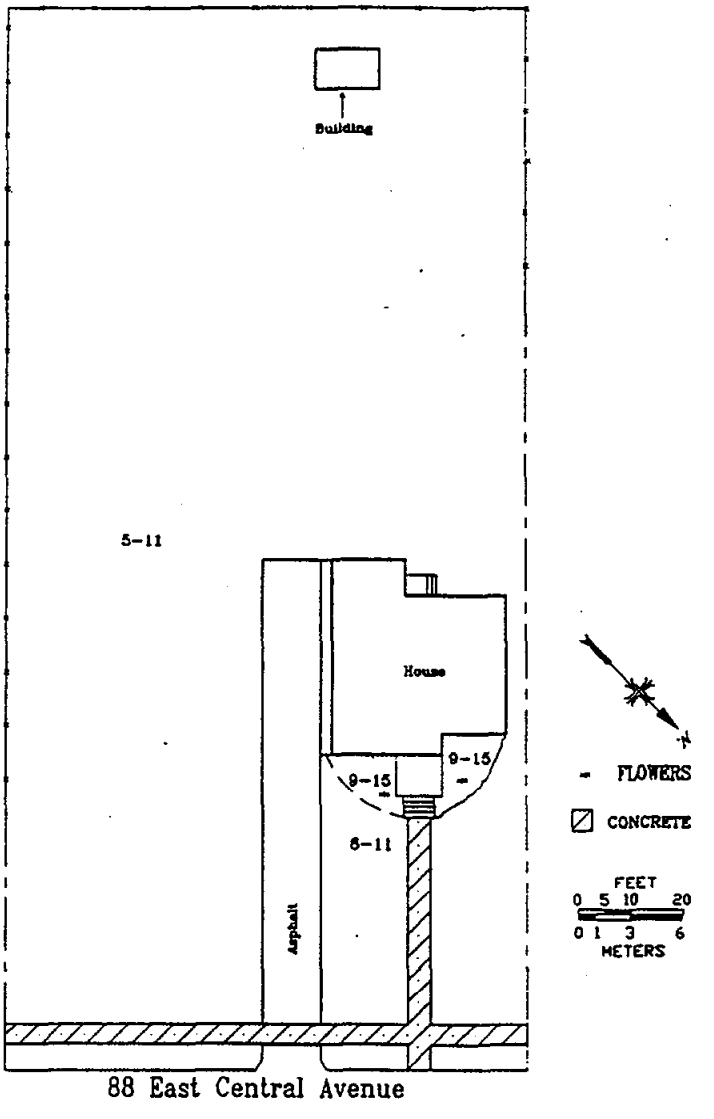

Fig. 1. Gamma radiation levels (μR/h) measured on the surface at 88 East Central Avenue, Maywood, New Jersey (MJ037).

ORNL-DWG 89-12312

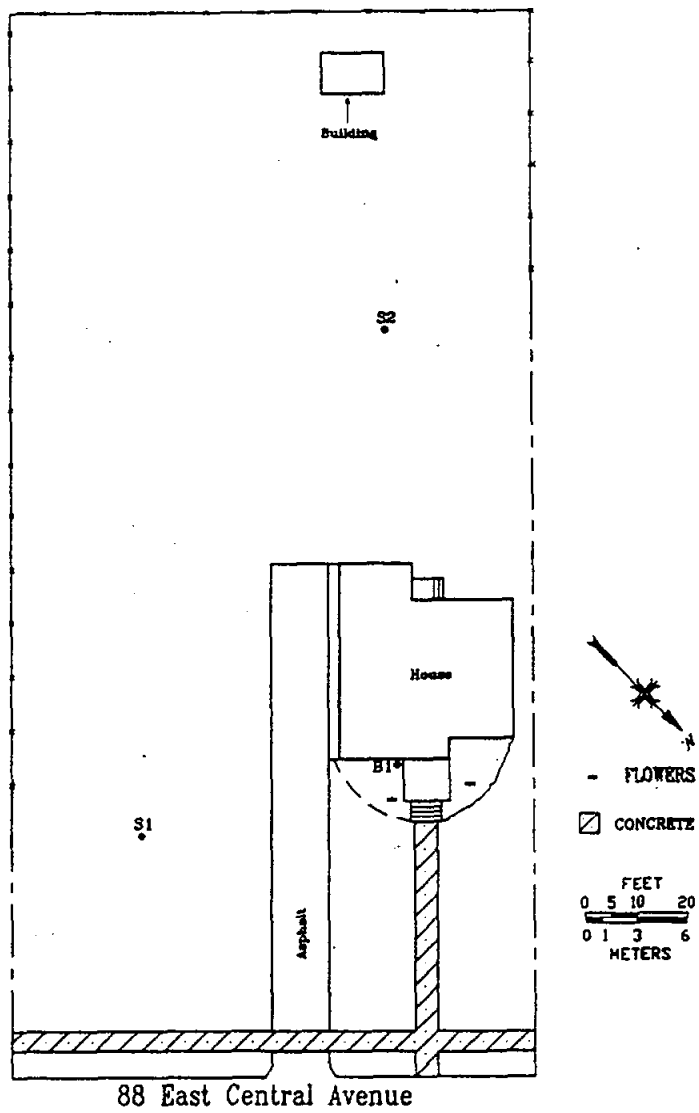

Fig. 2. Diagram showing locations of soil samples taken at 88 East Central Avenue, Maywood, New Jersey (MJ037).

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

[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]
Concentration of radionuclides in soil (pCi/g)	
^{232}Th	0.9
^{238}U	0.9
^{226}Ra	0.9

[a]Reference 4.

Table 3. Concentrations of radionuclides in soil at 88 East Central Avenue, Maywood, New Jersey (MJ037)

Sample[a]	Depth (cm)	Radionuclide concentration (pCi/g)		
		^{226}Ra[b]	^{232}Th[b]	^{238}U[b]
		Systematic samples[c]		
S1A	0–15	0.81±0.1	0.96±0.03	<1.7
S1B	15–30	1.0 ±0.2	0.98±0.04	1.4±1
S2A	0–15	0.85±0.02	1.0 ±0.03	<2.5
S2B	15–30	0.74±0.05	0.87±0.06	<2.5
		Biased samples[d]		
B1A	0–15	0.84±0.03	0.95±0.05	<4.7
B1B	15–30	0.76±0.07	0.93±0.05	1.2±0.7

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

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

[c]Systematic samples are taken at grid locations irrespective of gamma radiation levels.

[d]Biased samples are taken from areas shown to have elevated gamma exposure rates.

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