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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 83 BELLE AVENUE, MAYWOOD,  
NEW JERSEY (MJ047)**

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**MASTER**

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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  $^{232}\text{Th}$ , 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, 83 Belle Avenue, Maywood, New Jersey (MJ047), was conducted during 1988.

Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions were not significantly different from normal background levels in the northern New Jersey area.

# RESULTS OF THE RADIOLOGICAL SURVEY AT 83 BELLE AVENUE, MAYWOOD, NEW JERSEY (MJ047)\*

## 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 U.S. 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 of the Oak Ridge National Laboratory.

A radiological survey of the private, residential property at 83 Belle Avenue, Maywood, New Jersey, was conducted during 1988. The survey and sampling of the ground surface were carried out on May 13, 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 gamma scan of the entire property outdoors, both at the surface and one meter above the surface, and (2) collection of soil samples. These 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 and one meter above the surface. Systematic soil samples were taken at various locations on the property, irrespective of gamma radiation levels. These samples were taken from the surface to a depth of 15 cm. A comprehensive description of the survey methods and instrumentation has been presented in another report.<sup>2</sup>

## SURVEY RESULTS

Applicable federal guidelines are summarized in Table 1.<sup>3</sup> The normal background radiation levels for the northern New Jersey area are presented in Table 2.<sup>4,5</sup> These data are provided for comparison with survey results presented in this report. 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, with corresponding measurements one meter above the surface where indicated. Gamma exposure rates over the major portion of the property ranged from 4 to 9  $\mu\text{R}/\text{h}$ . Both one-meter measurements were 7  $\mu\text{R}/\text{h}$ ; the normal background level at one meter averages 8  $\mu\text{R}/\text{h}$  for the northern New Jersey area (Table 2). The highest gamma levels were found on the front steps and around the foundation of the house, ranging from 10 to 15  $\mu\text{R}/\text{h}$ . This slight elevation in gamma levels is typical of the naturally occurring radioactive substances present in bricks, concrete, granite, and other such materials used in paving and building construction. Otherwise, none of the measurements were elevated.

### Systematic Soil Samples

Systematic soil samples were taken from various locations on the property for radionuclide analyses. Locations of the systematic (S) samples 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 0.71 to 0.73 pCi/g, 0.74 to 0.81 pCi/g, and 1.2 to 2.1 pCi/g, respectively. Both samples were below DOE criteria (Table 1) and near or below background level for the northern New Jersey area (Table 2).

## SIGNIFICANCE OF FINDINGS

Measurements and results of soil sample analyses taken at 83 Belle Avenue indicate that the property contained no radionuclide concentrations above DOE guideline values. The radionuclide distributions on this property were similar to normal background levels for the northern New Jersey area.

## REFERENCES

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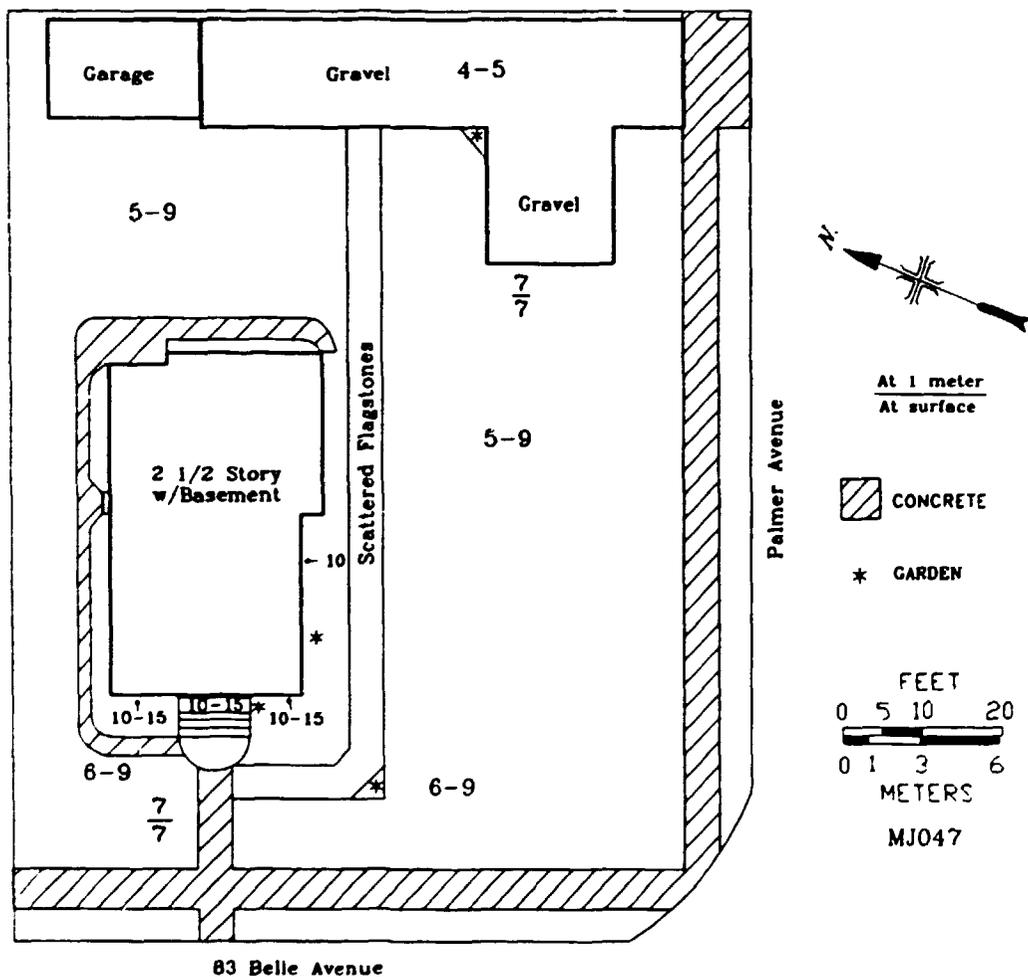


Fig. 1. Gamma radiation levels ( $\mu\text{R/h}$ ) measured on the surface at 83 Belle Avenue, Maywood, New Jersey (MJ047), with corresponding measurements one meter above the surface where indicated.

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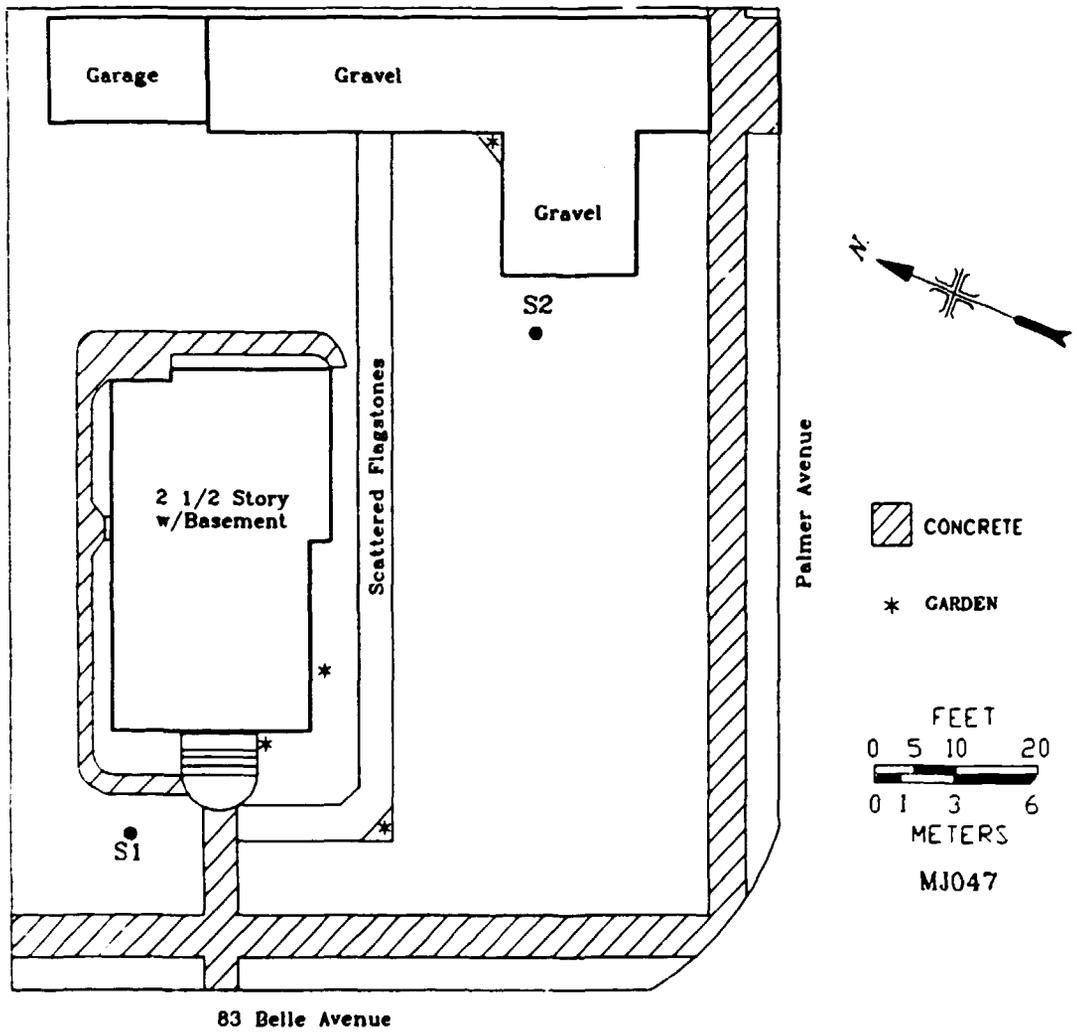


Fig. 2. Diagram showing locations of soil samples taken at 83 Belle Avenue, Maywood, New Jersey (MJ047).

Table 1. Applicable guidelines for protection against radiation<sup>a</sup>

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 <sup>2</sup> area <sup>232</sup> Th <sup>230</sup> Th <sup>228</sup> Ra <sup>226</sup> Ra <sup>238</sup> U	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     Derived (site specific)

<sup>a</sup>Reference 3.

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

Type of radiation measurement or sample	Radiation level or radionuclide concentration <sup>a</sup>
Gamma exposure at 1 m above ground surface ( $\mu$ R/h)	8 <sup>b</sup>
Concentration of radionuclides in soil (pCi/g)	
<sup>226</sup> Ra	0.9 <sup>c</sup>
<sup>232</sup> Th	0.9 <sup>c</sup>
<sup>238</sup> U	0.9 <sup>c</sup>

<sup>a</sup>These values represent an average of normal radionuclide concentrations in this part of the state. Actual values may fluctuate.

<sup>b</sup>Reference 4.

<sup>c</sup>Reference 5.

**Table 3. Concentrations of radionuclides in soil at  
83 Belle Avenue, Maywood, New Jersey (MJ047)**

Sample <sup>a</sup>	Depth (cm)	Radionuclide concentration (pCi/g)		
		<sup>226</sup> Ra <sup>b</sup>	<sup>232</sup> Th <sup>b</sup>	<sup>238</sup> U <sup>b</sup>
<i>Systematic samples<sup>c</sup></i>				
S1	0-15	0.71±0.01	0.74±0.02	2.1±0.7
S2	0-15	0.73±0.008	0.81±0.01	1.2±0.3

<sup>a</sup>Locations of soil samples are shown on Fig. 2.

<sup>b</sup>Indicated counting error is at the 95% confidence level ( $\pm 2\sigma$ ).

<sup>c</sup>Systematic samples are taken at locations irrespective of gamma exposure rates.