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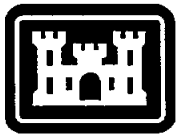
Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the Maywood Site, New Jersey



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RESULTS OF THE RADIOLOGICAL SURVEY AT 17 JOHN STREET, LODI, NEW JERSEY (LJ088)

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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, 17 John Street, Lodi, New Jersey (LJ088), 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 17 JOHN STREET, LODI, NEW JERSEY (LJ088)*

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.

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

*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.

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 17 John Street, Lodi, New Jersey, was conducted during 1988. The survey and sampling of the ground surface were carried out on May 10, 1988, and the follow-up subsurface investigation was performed on June 8, 1988.

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, (2) collection of soil samples, and (3) a gamma scan of an auger hole. 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.

To define the extent of possible subsurface soil contamination, an auger hole was drilled to a depth of approximately 3.0 m. An unshielded NaI scintillation probe was lowered into the hole through the auger pipe. Measurements were usually made at 15– or 30–cm intervals. If the gamma readings in the hole were elevated, a soil sample was scraped from the wall of the auger hole at the point showing the highest gamma radiation level. 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.[4,5] 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 10 μR/h. Both one–meter measurements were 6 μR/h; the normal background level at one meter is 8 μR/h for the northern New Jersey area (Table 2). The highest gamma level was 12 μR/h at the foundation of the house. 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 0.72 to 0.79 pCi/g, 0.79 to 0.85 pCi/g, and 0.70 to <2.5 pCi/g, respectively. All samples were below DOE criteria (Table 1) and not significantly different from normal background levels for the northern New Jersey area (Table 2).

Auger Hole Gamma Scan

One auger hole (A) was drilled to a depth of 2.9 m at the location indicated in Fig. 2. A gamma scan of this hole with an unshielded probe was used to characterize and further define the extent of possible contamination. The scanning technique used here is not radionuclide specific. However, auger hole gamma data, in conjunction with soil analyses data, have previously been used to estimate regions of elevated radionuclide concentrations in auger holes when compared with background levels for this area. Following a comparison of these data, it appears that any unshielded scintillator readings of 6000 counts per minute (cpm) or greater generally indicate the presence of elevated concentrations of ^{226}Ra and/or ^{232}Th. Readings in this hole were between 1800 and 2800 cpm; therefore, no auger soil samples were taken for analyses since all readings were below background for this area.

SIGNIFICANCE OF FINDINGS

Measurements and results of soil sample analyses taken at 17 John Street indicate that the property contained no radionuclide concentrations above DOE guideline values. The radionuclide distributions on this property were not significantly different from normal background levels for the northern New Jersey area. The slight elevations in radionuclide levels are typical of the naturally occurring radioactive substances present in bricks, concrete, granite, and other such materials used in paving and building construction.

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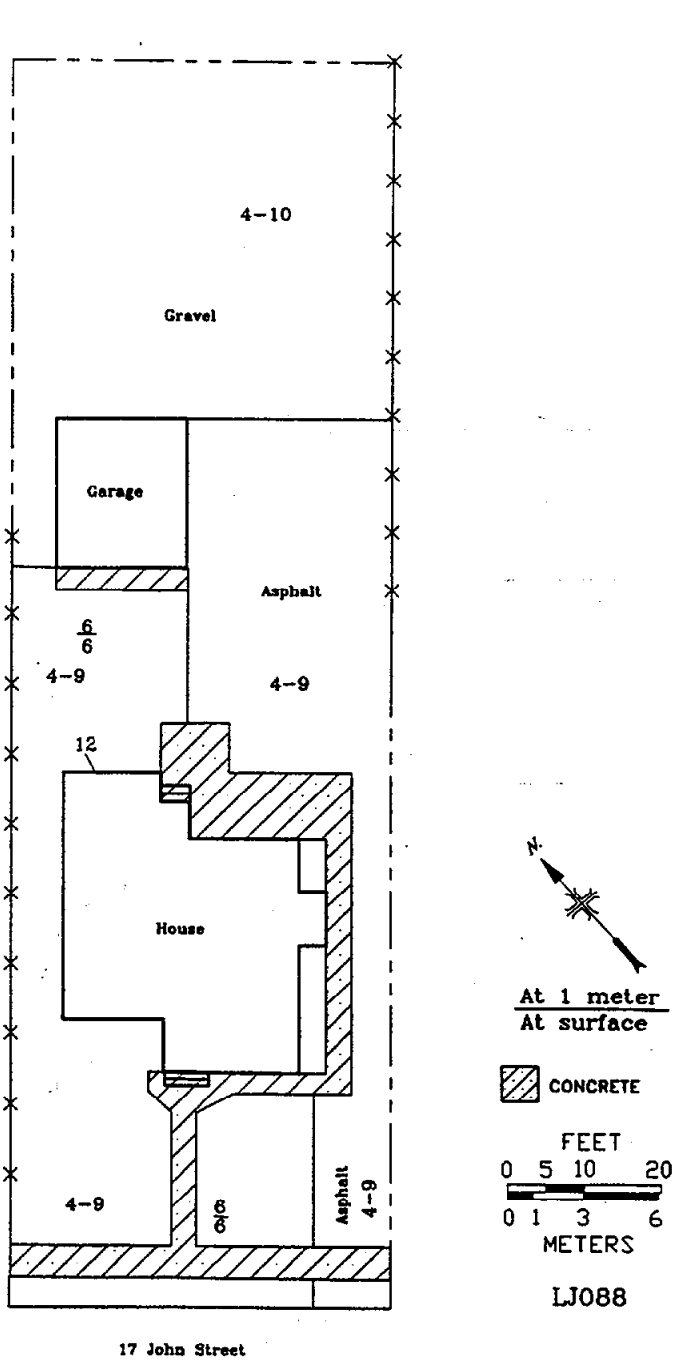

Fig. 1. Gamma radiation levels (μR/h) measured on the surface at 17 John Street, Lodi, New Jersey (LJ088), with corresponding measurements one meter above the surface where indicated.

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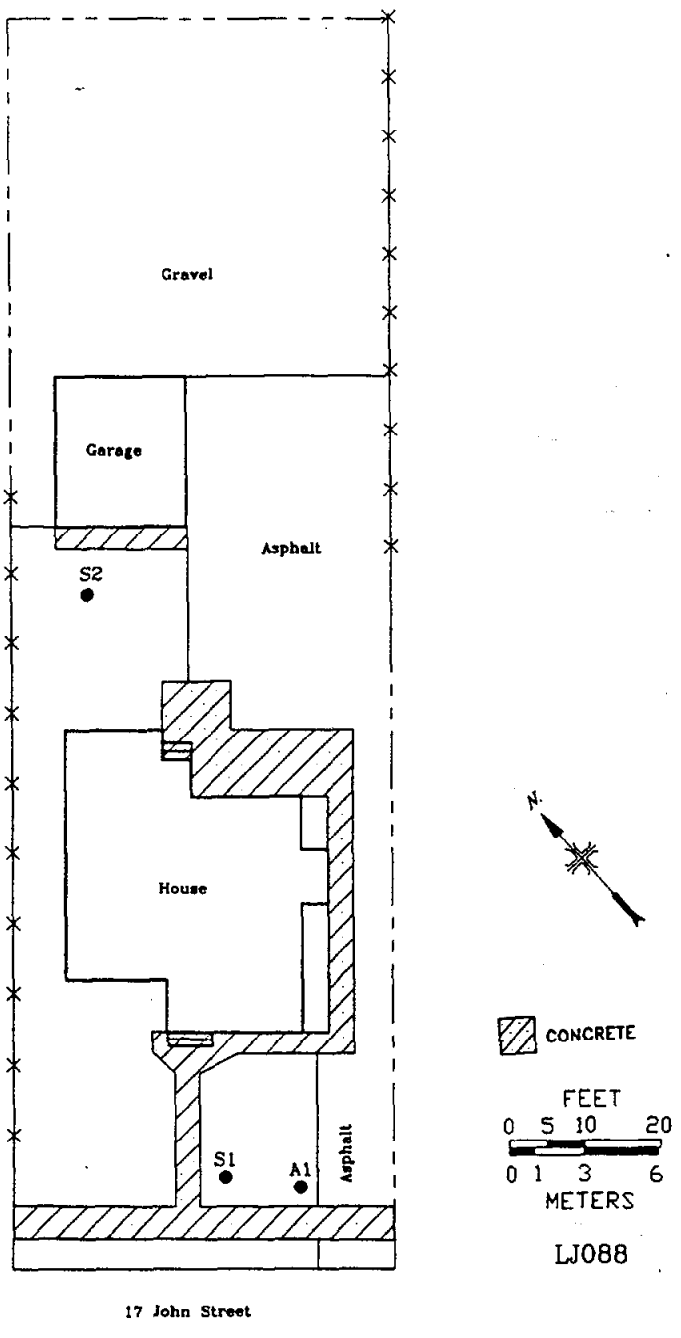

Fig. 2. Diagram showing locations of soil samples taken at 17 John Street, Lodi, New Jersey (LJ088).

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 5.

Table 3. Concentrations of radionuclides in soil at 17 John Street, Lodi, New Jersey (LJ088)

Sample[a]	Depth (cm)	Radionuclide concentration (pCi/g)		
		^{226}Ra[b]	^{232}Th[b]	^{238}U[b]
		Systematic samples[c]		
S1A	0–15	0.79±0.02	0.85±0.03	<2.5
S1B	15–30	0.75±0.02	0.82±0.04	2.3 ±0.6
S2A	0–15	0.72±0.007	0.79±0.01	0.70±0.2
S2B	15–30	0.74±0.3	0.82±0.01	1.1 ±0.3

[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 locations irrespective of gamma exposure rates.

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