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Formerly Utilized Sites Remedial Action Program (FUSRAP)

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# ADMINISTRATIVE RECORD

for the Maywood Site, New Jersey

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**US Army Corps  
of Engineers®**

M-7/6

ORNL/RASA-88/71

HEALTH AND SAFETY RESEARCH DIVISION

Waste Management Research and Development Programs  
(Activity No. AH 10 05 00 0; NEAH001)

RESULTS OF THE RADIOLOGICAL  
SURVEY OF THE SADDLE RIVER'S EAST BANK,  
FROM STATE HIGHWAY 46 TO THE RIVER'S CONFLUENCE  
WITH LODI BROOK, LODI, NEW  
JERSEY (LJ083)

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Date Published - November 1989

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MARTIN MARIETTA ENERGY SYSTEMS, INC.  
for the  
U. S. DEPARTMENT OF ENERGY  
under contract DE-AC05-84OR21400

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## ACKNOWLEDGMENTS

Research for this project was sponsored by the Division of Facility and Site Decommissioning Projects, U.S. Department of Energy, 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 J. L. Rich, S. W. Hawthorne, and L. J. Jeffers of the Publications Division; M. S. Uziel of the Environmental Remediation Group; D. A. Roberts and T. R. Stewart of the Measurement Applications and Development Group; A. C. Butler, former employee of Martin Marietta Energy Systems, Inc.; and W. H. Shinpaugh of Don Stone Associates for 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  $^{232}\text{Th}$ , 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, the Saddle River's East Bank, from State Highway 46 to the River's Confluence with Lodi Brook, Lodi, New Jersey (LJ083), 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.

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**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

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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.



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 east bank of the Saddle River, from State Highway 46 to the river's confluence with Lodi Brook, Lodi, New Jersey, was conducted during 1988. The survey and sampling of the ground surface were carried out on May 8 and 12 and June 5, 1988.

## SURVEY METHODS

The radiological survey of the property included: (1) a gamma scan of the accessible portions of the river's bank from the property fences to the water's edge and (2) collection of soil samples. Most of the samples were taken near the water line. However, some were taken several feet above this line, and one sample (S17) was a sediment sample taken from a sand/gravel bar, which was located near midstream just below the confluence of the river and Lodi Brook.

Using a portable gamma scintillation meter, ranges of measurements were recorded for areas of the property surface. Systematic soil samples were taken at various locations on the property, irrespective of gamma radiation levels.

Soil samples were usually taken from the surface to a depth of 15 cm. Occasionally, deeper samples were taken at 15-cm intervals to a maximum depth of 45 cm. Soil samples S3A&B, S7A-C, and S18A-C were taken laterally from the surface every 2 to 3 feet starting at the water's edge. These survey methods followed the plan outlined in Reference 1. 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</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.

### Surface Gamma Radiation Levels

Gamma radiation levels measured during a gamma scan along the surface of the river bank at the water's edge are given in Fig. 1. Gamma exposure rates

along the river bank ranged from 4 to 11  $\mu\text{R}/\text{h}$ . 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 all but one of the systematic (S) samples are shown in Fig. 2, with results of laboratory analyses provided in Table 3. The sample (S22) not shown in Fig. 2 was taken approximately 3 feet from the water's edge and 135 feet upstream from the State Highway 46 bridge (northeast of the bridge) Since elevated gamma levels were not detected, biased samples were not taken. Concentrations of radium, thorium, and uranium in these samples ranged from 0.32 to 0.70 pCi/g, 0.40 to 1.2 pCi/g, and 0.49 to 2.3 pCi/g, respectively. All samples were below DOE criteria (Table 1) and near or below normal background levels for the northern New Jersey area (Table 2).

### SIGNIFICANCE OF FINDINGS

Measurements and results of soil sample analyses taken along the east bank of the Saddle River, from State Highway 46 to the river's confluence with Lodi Brook, 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.

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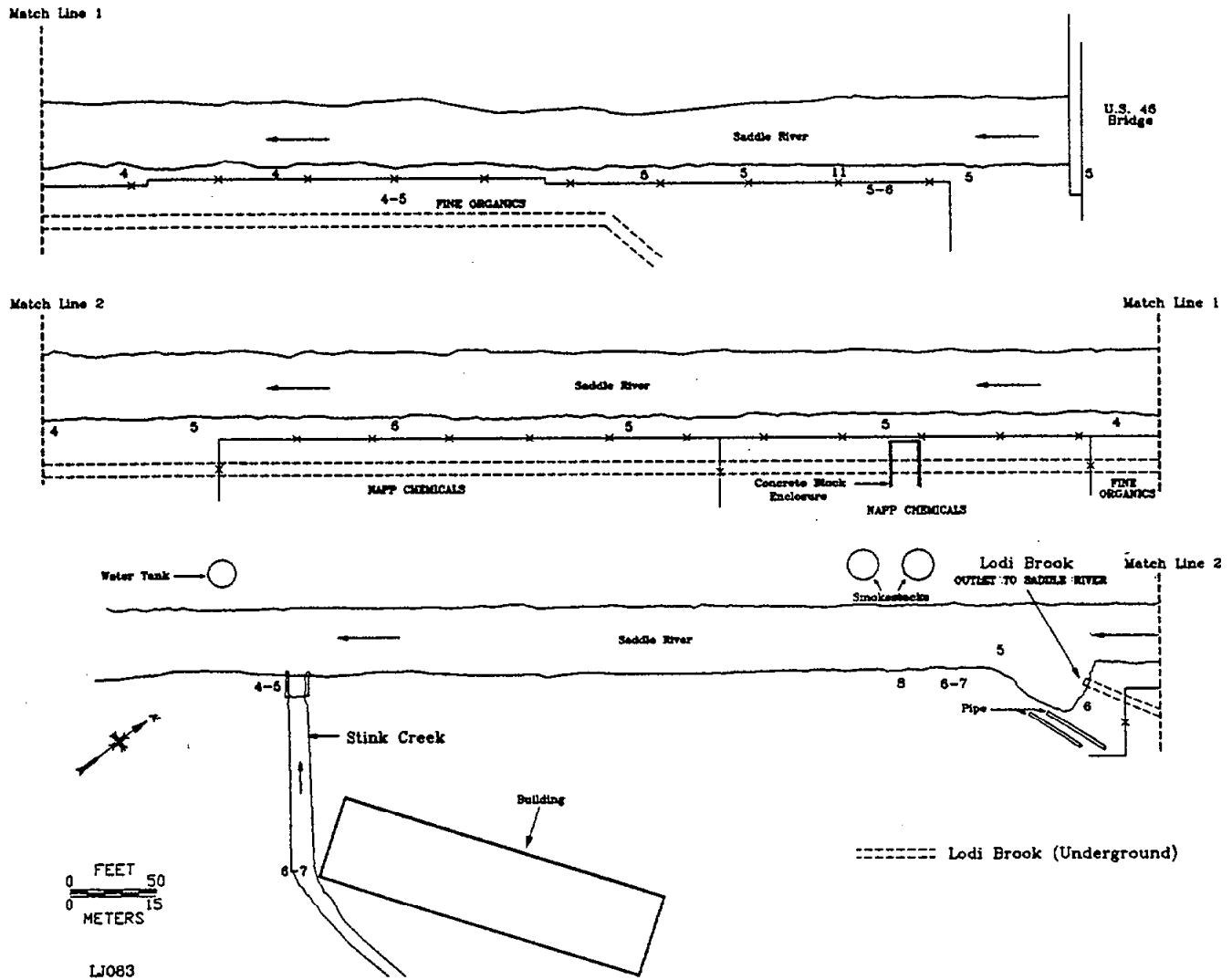


Fig. 1. Gamma radiation levels ( $\mu\text{R/h}$ ) measured along the surface of the Saddle River's East Bank, from State Highway 46 to the river's confluence with Lodi Brook, Lodi, New Jersey (LJ083).

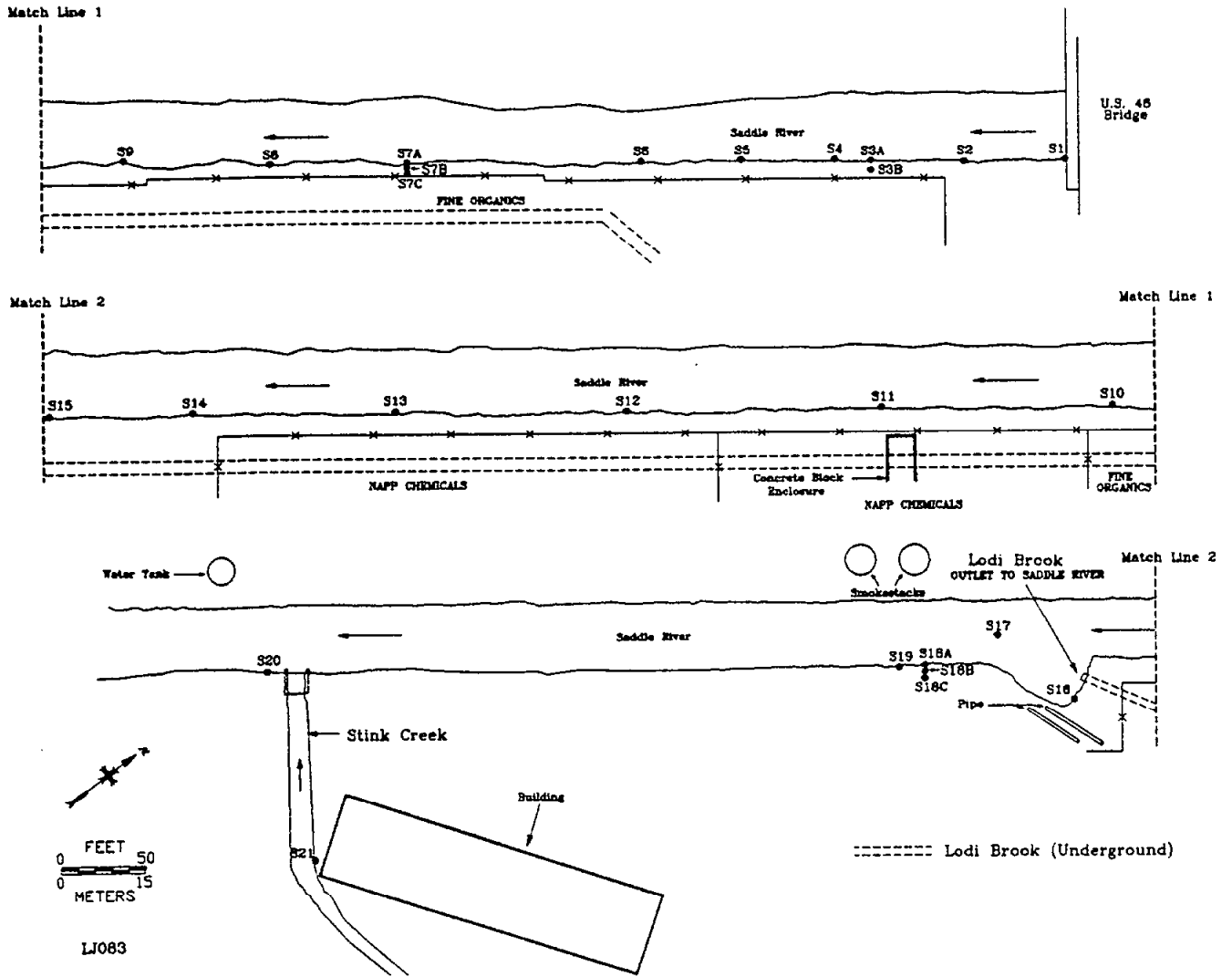


Fig. 2. Diagram showing locations of soil samples taken along the Saddle River's East Bank, from State Highway 46 to the river's confluence with Lodi Brook, Lodi, New Jersey (LJ083).

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 in soil from the northern New Jersey area

Radionuclide	Concentration (pCi/g) <sup>a</sup>
<sup>226</sup> Ra	0.9 <sup>b</sup>
<sup>232</sup> Th	0.9 <sup>b</sup>
<sup>238</sup> U	0.9 <sup>b</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.

Table 3. Concentrations of radionuclides in soil along the Saddle River's East Bank, from State Highway 46 to the river's confluence with Lodi Brook, Lodi, New Jersey (LJ083)

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	0.42±0.05	0.58±0.02	1.1 ±0.8
S2	0-15	0.59±0.01	0.69±0.02	<1.6
S3A <sup>d</sup>	0-15	0.62±0.03	0.70±0.03	1.4 ±2
S3B <sup>d</sup>	0-15	0.61±0.008	0.68±0.01	1.2 ±0.4
S4	0-15	0.52±0.007	0.63±0.01	0.82±0.2
S5	0-15	0.38±0.005	0.41±0.1	0.64±0.1
S6	0-15	0.56±0.007	0.62±0.01	0.52±0.4
S7A <sup>d</sup>	0-15	0.60±0.1	0.68±0.05	0.94±0.9
S7B <sup>d</sup>	0-15	0.70±0.009	0.76±0.02	2.3 ±0.6
S7C <sup>d</sup>	0-15	0.63±0.02	0.69±0.03	<2.3
S8	0-15	0.65±0.03	0.70±0.04	1.4 ±0.8
S9	0-15	0.61±0.006	0.67±0.01	0.74±0.2
S10	0-15	0.41±0.007	0.48±0.01	1.2 ±0.3
S11	0-15	0.51±0.01	0.58±0.02	0.84±0.3
S12	0-15	0.32±0.03	0.40±0.06	0.87±0.6
S13	0-15	0.40±0.03	0.48±0.01	<0.88
S14	0-15	0.54±0.007	0.64±0.01	1.5 ±0.3
S15	0-15	0.39±0.008	0.44±0.02	<0.50
S16	0-15	0.63±0.009	1.2 ±0.02	2.3 ±0.6
S17	0-15	0.47±0.006	0.56±0.01	1.1 ±0.3
S18A <sup>d</sup>	0-15	0.65±0.006	0.80±0.01	1.1 ±0.2
S18B <sup>d</sup>	0-15	0.51±0.07	0.63±0.06	1.1 ±1
S18C <sup>d</sup>	0-15	0.37±0.008	0.41±0.01	0.96±0.3
S19	0-15	0.63±0.01	0.88±0.02	<2
S20A	0-15	0.44±0.08	0.48±0.04	0.49±1.3
S20B	15-30	0.45±0.02	0.52±0.05	<0.89
S21A	0-15	0.55±0.006	0.52±0.01	1.0 ±0.2
S21B	15-30	0.52±0.04	0.53±0.05	1.6 ±0.7
S21C	30-45	0.66±0.03	0.68±0.06	1.2 ±0.8
S22	0-15	0.56±0.1	0.70±0.04	1.3 ±0.1

<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.

<sup>d</sup>Samples were taken laterally every 2 to 3 feet starting from the water's edge. Sample depth is indicated.

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