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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 INDEPENDENT RADIOLOGICAL VERIFICATION SURVEY AT 467 LATHAM STREET, MAYWOOD, NEW JERSEY (MJ12L)

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ORNL/RASA-86/59
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HEALTH AND SAFETY RESEARCH DIVISION

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

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RESULTS OF THE INDEPENDENT RADIOLOGICAL VERIFICATION SURVEY AT 467 LATHAM STREET, MAYWOOD, NEW JERSEY (MJ12L)*

INTRODUCTION

Processing of thorium ores was performed in Maywood, New Jersey, between 1916 and 1956 by the Maywood Chemical Works.[1] During the course of thorium processing the wastes from the operations were pumped to diked areas west of the plant. Additional material was placed in two piles surrounded by earthen dikes. In 1932, Route 17 was built through this disposal area. The Maywood Chemical Works ceased thorium processing in 1956 and subsequently was sold to Stepan Chemical Company in 1959. After 1963, on several occasions wastes were removed from the west side of New Jersey Route 17. This area is now owned by Ballod and Associates. In 1984, the U.S. Department of Energy (DOE) was assigned the responsibility by Congress for the decontamination project involving the site and vicinity properties in Maywood and Rochelle Park under the Formerly Utilized Sites Remedial Action Program (FUSRAP).

This site, referred to as the Maywood site, had surface and subsurface radionuclide concentrations in excess of the DOE criteria listed in Table 1. It has been identified through radiological assessment procedures by Oak Ridge Associated Universities and Nuclear Safety Associates, Inc.,[1,2] for the purpose of decontamination based on DOE's remedial action objectives. The Maywood site and vicinity properties, which include the residential properties on Latham and Davison Streets in Maywood, were assigned by DOE to FUSRAP although the contamination at the Maywood site did not result from the Atomic Energy Program.

From June to December, 1984, Bechtel National, Inc. (BNI), the project management contractor designated by DOE, performed remedial action on this residential property. This remedial action is on one of six designated properties in the Maywood area (Fig. 1). Based on drawings showing the extent of contamination, the property was excavated and the contaminated material transported to the Maywood Interim Storage Site (MISS), adjacent to the Stepan Company plant.[3] After removal of all contaminated soil, the property was restored to its original condition. By using a combination of procedures, the contamination was controlled and prevented from spreading to other areas. A post-remedial radiological survey was conducted by BNI to ensure compliance with DOE remedial action guidelines.[4]

The DOE adopted a policy to assign an independent verification contractor to ensure the effectiveness of remedial actions performed within FUSRAP. The Radiological Survey Activities Group of Oak Ridge National Laboratory (ORNL) has been assigned the responsibility for this task at the Maywood site. This report describes the methods and results of that verification.

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*The survey was performed by members of the Radiological Survey Activities Group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc.

Gamma Measurements

Results of grid point measurements made by BNI are presented in the confirmatory report (Ref. 4). Gamma measurements were made approximately 30 cm above each grid point using a Primary Excavation Control Instrument (PECI). Gamma exposure rates at 30 cm above ground surface ranged from 4422 to 9420 counts per minute (cpm). The maximum gamma exposure rate of 9420 cpm was measured in the excavated area at the back side of the property at approximately grid location E347, N156. It was indicated by BNI that, on this site, a reading of 13,000 cpm on the PECI corresponds to a concentration of 5 pCi (picocuries*) of ^{232}Th per gram of soil.

One pressurized ionization chamber (PIC) reading was taken at this property by BNI. The result and the location of the reading are presented in Table 3. The gamma exposure rate at 1 m above ground surface averaged 11 μR/h (microroentgens† per hour).

Soil Sampling

Before backfilling, soil samples were taken by BNI in excavated areas. The procedures used for soil sample analysis have been described in Ref. 3. Results of soil sample analysis and locations of samples are given by BNI in the post-remedial confirmatory report.

Two systematic BNI soil samples from different locations were selected for independent verification by ORNL (see Table 4). The two samples have been analyzed for ^{238}U, ^{226}Ra, and ^{232}Th according to the procedure described in Ref. 6.

Concentrations of ^{238}U in the soil samples ranged from 0.8 to 0.9 pCi/g and averaged 0.8 pCi/g. Concentrations of ^{226}Ra in the soil samples ranged from 0.79 to 0.88 pCi/g and averaged 0.8 pCi/g. Concentrations of ^{232}Th in the two soil samples were each 1.3 pCi/g. Locations of the soil samples are shown in Fig. 3. Results of ORNL analyses for the aforementioned two soil samples are given in Table 4, with results by BNI in parentheses for comparison. The significance of difference between average ORNL values and average BNI values was tested by a single-sample t-test assuming ratios of paired values are log normally distributed. For 2 degrees of freedom and a 0.05 level of significance, the values in the critical range for a t-test of the null hypothesis are greater than 4.3. The observed t values for ^{226}Ra and ^{232}Th are 1.1 and 1.4, respectively, neither of which is significant. The associated P values are 0.4 and 0.3, respectively. Hence, there is no evidence in these data to indicate that the average log ratio is different from zero. Because BNI's results for ^{238}U were not absolute, no statistical test was performed for this radionuclide.

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*The curie is a unit used to define the radioactivity in a substance and equals that quantity of any radioactive isotope undergoing 2.2×10^{12} disintegrations per minute. The picocurie is one million-millionth of a curie or that amount yielding 2.2 disintegrations per minute.

†The roentgen (R) is a unit which was defined for radiation protection purposes for people exposed to penetrating X rays or gamma radiation. A microroentgen (μR) is one millionth of a roentgen. A milliroentgen (mR) is one thousandth of a roentgen or one thousand microroentgens.

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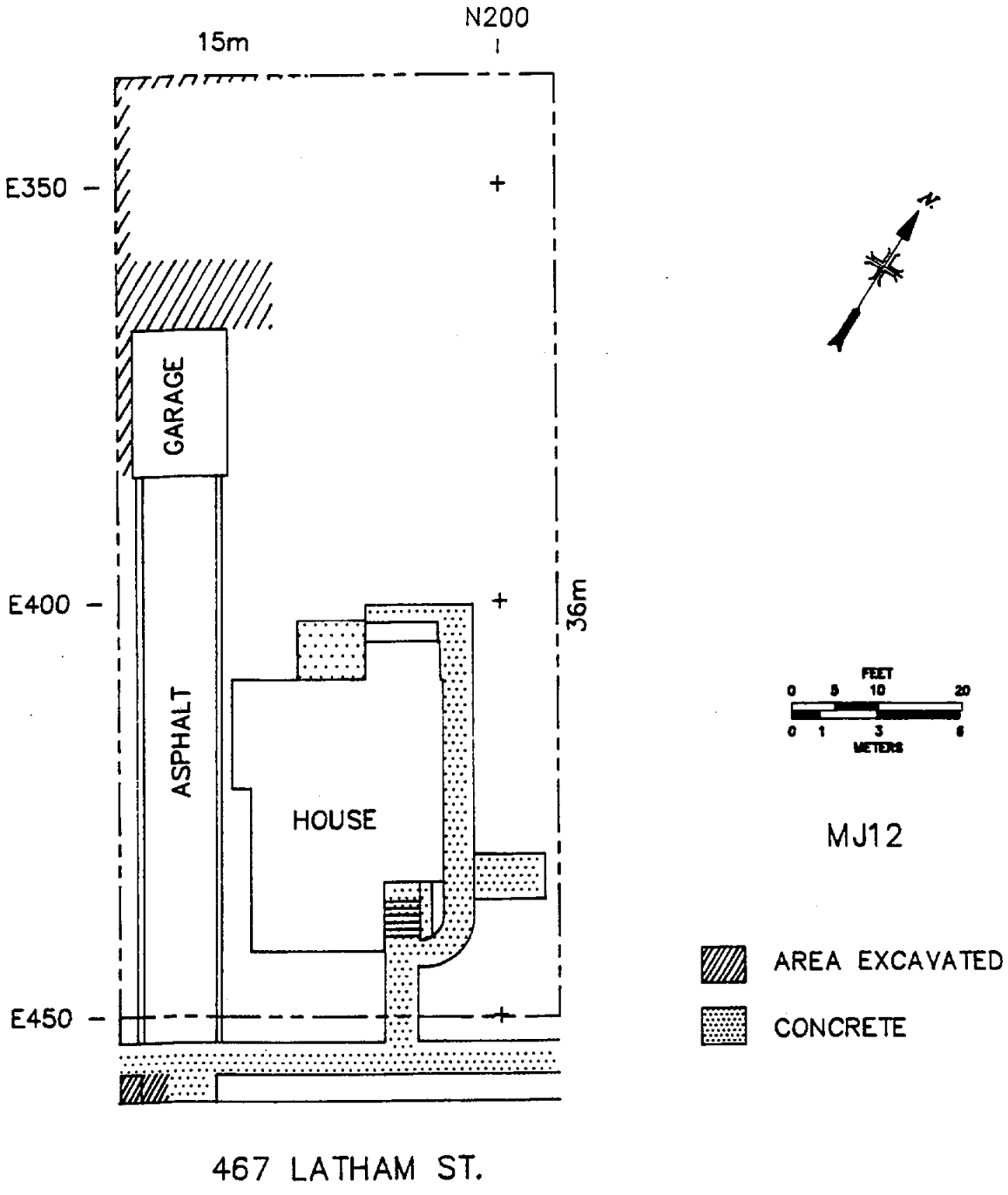

Fig. 2. Diagram showing grid point and grid block locations outdoors on the property at 467 Latham St., Maywood, New Jersey (MJ12L).

Table 1. Summary of residual contamination guidelines for the Maywood, New Jersey, site

Soil (Land) Guidelines (Maximum Limits for Unrestricted Use)

Radionuclide	Soil concentration (pCi/g) above background[a,b]
^{226}Ra ^{228}Ra ^{230}Th ^{232}Th	5 pCi/g, averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over any 15-cm-thick soil layer below the surface layer
Other radionuclides	Soil guidelines will be calculated on a site-specific basis using the DOE manual developed for this use

Structure Guidelines (Maximum Limits for Unrestricted Use)

Indoor Radon Decay Products

For ^{222}Ra and ^{220}Rn concentrations in buildings, the average annual radon decay product concentration (including background) due to uranium or thorium by-products should not exceed 0.02 WL after remedial action. When remedial action has been performed and it would be unreasonably difficult and costly to reduce the level below 0.03 WL, the remedial action may be terminated, and the reasons for termination should be documented. Remedial action shall be undertaken for any building that exceeds an annual average radon decay product concentration (including background) of 0.03 WL.

Indoor Gamma Radiation

The indoor gamma radiation after decontamination shall not exceed 20 microroentgen per hour (20 μR/h) above background in any occupied or habitable building.

Indoor/Outdoor Structure Surface Contamination

Radionuclide[d]	Allowable Surface Residual Contamination[c] (dpm/100 cm^2)		
	Average[e,f]	Maximum[e]	Removable[e]
Transuranics, ^{226}Ra, ^{228}Ru, ^{230}Th, ^{228}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I	100	300	20
Natural Th, ^{232}Th, ^{90}Sr, ^{223}Ra, ^{224}Ra, ^{232}U, ^{126}I, ^{131}I, ^{133}I	1,000	3,000	200
Natural U, ^{235}U, ^{238}U, and associated decay products	5,000	15,000	1,000

Table 2. Background radiation levels in the Maywood, New Jersey, area

Type of radiation measurement or sample	Radiation level or radionuclide concentration	
	Range	Average
Gamma exposure rate at 1 m above floor or ground surface (μR/h)[a]	8–11	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.13–1.4	0.86
^{226}Ra	0.24–1.4	0.87
^{232}Th	0.31–1.5	0.9

[a]Values obtained from 35 locations in the Rochelle Park area.[8]

[b]Soil samples obtained from locations around the Maywood area.[6]

Table 3. Result and location of the pressurized ionization chamber (PIC) measurement at 467 Latham St., Maywood, New Jersey (MJ12L)[a]

Coordinates		Gamma exposure rate (μR/h)
East	North	
365	157	11

[a]Ref. 4.

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