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**Radiological Verification
Survey Results at
13 Peck Ave.,
Pequannock, New Jersey
(PJ004V)**

**R. E. Rodriguez
C. A. Johnson**

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HEALTH SCIENCES RESEARCH DIVISION
Environmental Restoration and Waste Management Non-Defense Programs
(Activity No. EX 20 20 01 0; ADS317AEX))

**Radiological Verification Survey Results
at 13 Peck Ave.,
Pequannock, New Jersey (PJ004V)**

R. E. Rodriguez and C. A. Johnson

Date issued —May 1995

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ABSTRACT

The U. S. Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains Railroad Spur and eight vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W. R. Grace facility. The property at 13 Peck Ave., Pequannock, New Jersey is one of these vicinity properties.

At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at 1 meter, beta-gamma scans, and the collection of soil and debris samples for radionuclide analysis.

Results of the survey demonstrated that all radiological measurements on the property at 13 Peck Ave. were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

RADIOLOGICAL VERIFICATION SURVEY RESULTS AT 13 PECK AVE., PEQUANNOCK, NEW JERSEY (PJ004V)*

INTRODUCTION

As part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), the Department of Energy (DOE) conducted a remedial action project in 1993 at several residential vicinity properties in the Townships of Pequannock and Wayne, New Jersey. Figure 1 shows the general location of these vicinity properties.

From September to December 1993, a team from the Measurements Application and Development Group, ORNL, conducted radiological verification surveys of these remediated properties in the Wayne and Pequannock, New Jersey areas.

The property at 13 Peck Ave., Pequannock, was one of the properties that had previously been surveyed and designated for remedial action. After completion of the remediation, the team from ORNL conducted a radiological verification survey of this property at the request of DOE. The verification survey consisted primarily of a complete gamma scan of the grounds and the collection of soil samples for radionuclide analysis.

This report describes the radiological verification survey of the private residential property at 13 Peck Ave., Pequannock, New Jersey, conducted by the Oak Ridge National Laboratory (ORNL) at the request of the Department of Energy (DOE), Office of Environmental Restoration.

The property at 13 Peck Ave., Pequannock, New Jersey is a single family dwelling with asphalt driveway and walk, and separate garage (see Fig. 2).

A walkover survey of the property (a technician walks slowly over the property swinging a detection probe at ~1-2 inches from the ground surface) was conducted in October and November 1993 by ORNL's Measurement Applications and Development Group. The purpose of the survey, which included the remediated areas in the front, side and back yards, was to determine whether any radiological residues above guidelines remained on the property.

A field survey drawing showing 10-m grids and indicating soil sampling locations and gamma radiation measurements is included in this report as Fig. 2.

SCOPE OF THE SURVEY

A comprehensive description of the survey methods and instrumentation used in this survey is given in *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, ORNL/TM-8600 (April 1987), and *Measurement Applications and Development Group Guidelines*, ORNL-6782 (January 1995).

* The survey was performed by members of the Measurement Applications and Development Group of the Health Sciences Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

The radiological survey of this property included: (1) a surface gamma scan of the grounds, sidewalks, and driveway, and (2) the collection of surface and subsurface soil samples for analysis.

Gamma radiation levels were determined using a portable sodium iodide (NaI) gamma scintillation detector connected to a Victoreen ratemeter. Measurements were recorded and converted to $\mu\text{R/h}$. Because NaI gamma scintillators are energy dependent, measurements of gamma radiation levels in counts per minute (CPM) are normalized to pressurized ionization chamber (PIC) measurements to estimate gamma exposure rates in $\mu\text{R/h}$.

Surface (0-15 cm, or 0 to 6 in) and subsurface (15-30 cm, or 6 to 12 in) soil samples were collected at various locations over the property. Confirmatory samples were taken from the remediated areas and at locations where slightly elevated gamma levels had been identified. These are referred to as biased samples and are labeled B2 through B9. Systematic samples (S1-S9) were taken at random irrespective of gamma exposure rates. Locations of the samples are shown in Fig. 2, and results of the radionuclide analysis are shown in Table 1.

Direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background radiation levels have not been subtracted from radionuclide concentrations measured in environmental samples.

VERIFICATION SURVEY AND ANALYSIS

Gamma measurements at one meter from the surface ranged from 11 to 16 $\mu\text{R/h}$ over all the property as shown on Fig. 2. These measurements are comparable to the natural background levels for this area. Gamma measurements generally ranged from 11 to 26 $\mu\text{R/h}$ at the ground surface in the front and back yards, and up to 33 $\mu\text{R/h}$ at the surface of the remediated area in the southeast corner of the property at the juncture of the asphalt walk and drive (in front of the house).

Surface and subsurface soil samples were collected from the front and back yards of the property, including biased samples taken from the remediated areas in the front, back and side yards. All samples were analyzed for radium (^{226}Ra), thorium (^{232}Th), and uranium (^{238}U).

Samples B1, B6 and B8 were taken in areas that were subsequently remediated and re-scanned for beta and gamma radiation to ensure the removal of all contamination; therefore, these samples are not included in Table 1.

Results of the soil analyses are in picocuries per gram (pCi/g) and are shown in Table 1. Radionuclide concentrations of ^{226}Ra (including surface and subsurface soil) in systematic samples ranged from 0.47 to 0.92 pCi/g and from 0.59 to 1.5 pCi/g in the biased samples. Concentrations of ^{232}Th in systematic samples ranged from 0.66 to 3.9 pCi/g and from 0.69 to 7.8 pCi/g in biased samples. The maximum concentration of 7.8 pCi/g was found in sample B7, which is bounded by samples B2, S3, S6 and S9, all of which are below guidelines. Furthermore, although sample B7 was slightly above guidelines, the area in which this sample was taken was no more than 4 m² in size. These

values are all below the DOE guideline for these radionuclides in soil which is 5 and 15 pCi/g above background averaged over 100 m² for surface and subsurface soil, respectively.¹

Concentrations of ²³⁸U in soil ranged from 0.42 to 1.9 pCi/g in systematic samples, and from 0.70 to <8.4 pCi/g in the biased samples. These values are well below the site specific guidelines for uranium in soil.²

CONCLUSIONS

Gamma measurements on the property at 13 Peck Ave., Pequannock, New Jersey were comparable to the average values for the area. The previously remediated areas in the front and back yards of the property were thoroughly investigated for radionuclide residues. The results of soil radionuclide analysis for ²³⁸U, ²²⁶Ra, and ²³²Th indicate that all soil concentration measurements are within the limits prescribed by DOE radiological guidelines.

Based on the results of the remedial action data and confirmed by the verification survey data, all radiological measurements fall below the limits prescribed by DOE radiological guidelines established for this site. It is concluded that the portions of the site which had been remediated during this action successfully meet the DOE remedial action objectives.

¹ For residential properties in this area, the guideline for ²³²Th is 5 pCi/g for both surface and subsurface soil.

² DOE guidelines for uranium are derived on a site-specific basis. Guidelines of 100 pCi/g have been applied to this FUSRAP site. Source: J. W. Wagoner II, Director, Division of Off-Site Programs, Office of Environmental Restoration, U. S. Department of Energy, personal communication to L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U. S. DOE, April 25, 1995.

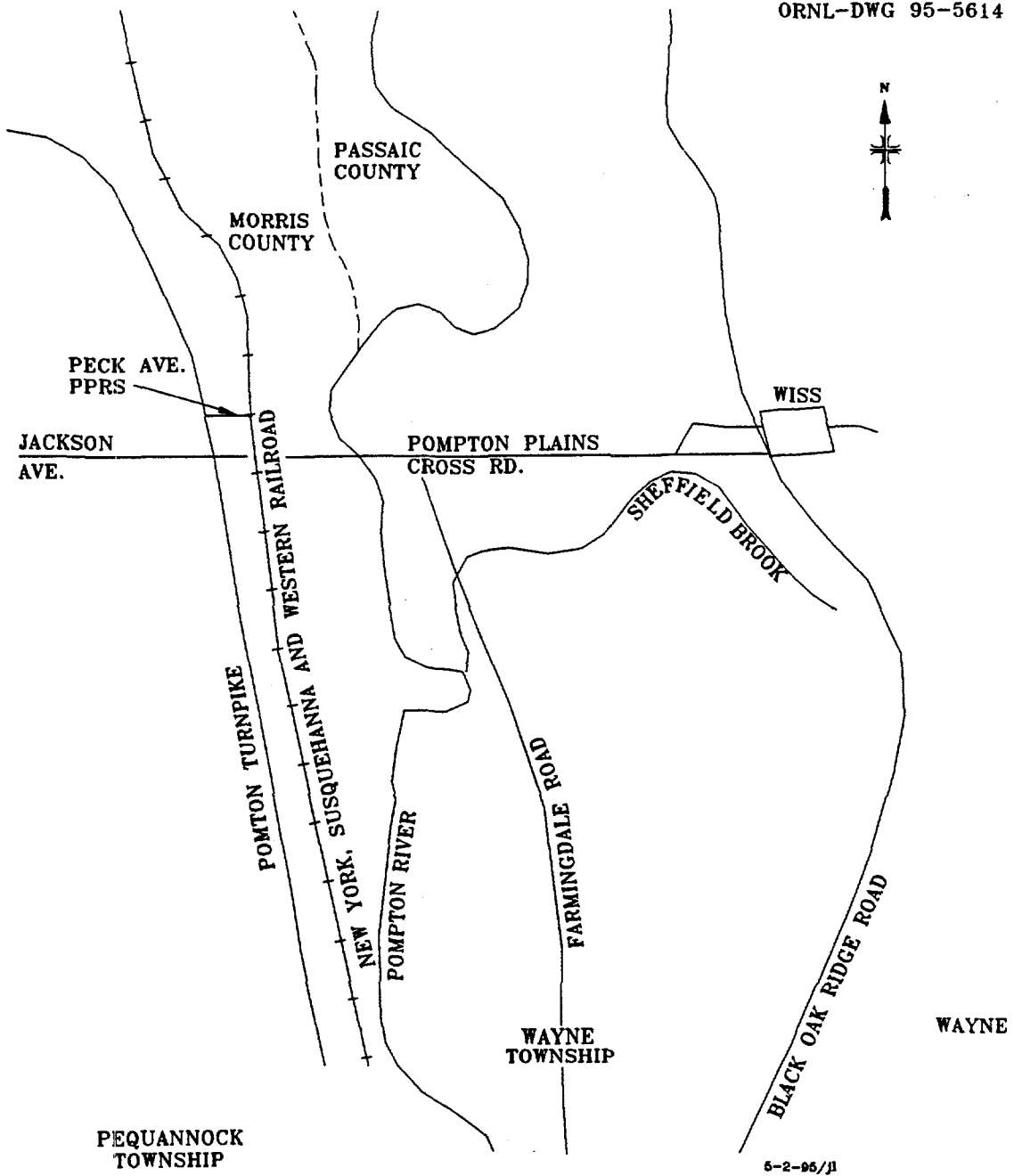


Fig. 1. Diagram showing general location of the Wayne Interim Storage Site (WISS) relative to the Wayne and Pequannock, New Jersey vicinity properties.

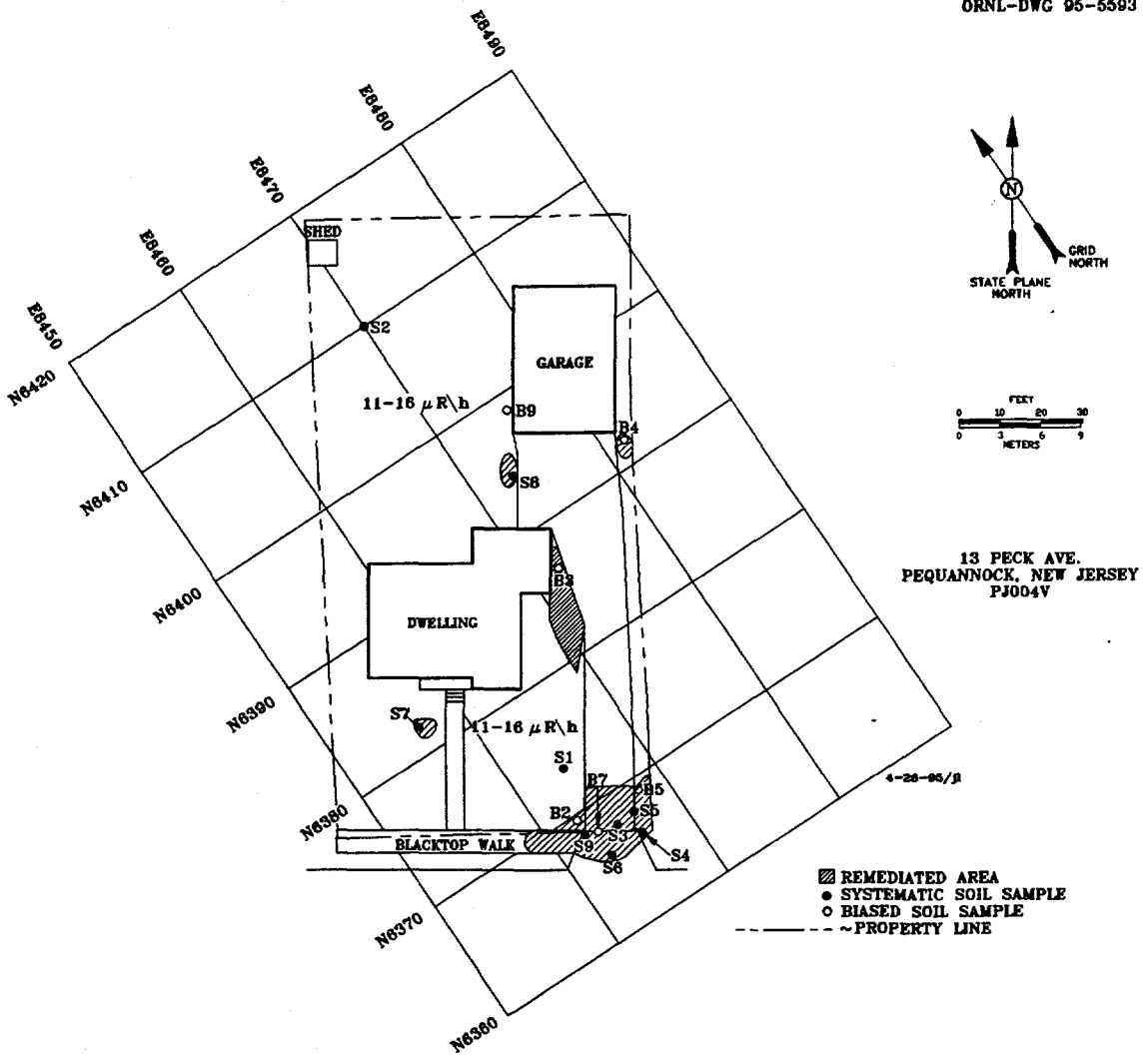


Fig. 2. Diagram of the property at 13 Peck Ave., Pequanock, New Jersey showing soil sampling locations and gamma measurements.

Table 1. Concentrations of radionuclides in soil and other materials at 13 Peck Ave., Pequannock, New Jersey (PJ004V)

| Sample number ^a | Grid location | Depth (cm) | Radionuclide concentration (pCi/g) ^b | | |
|---------------------------------------|---------------|------------|---|-------------------|------------------|
| | | | ²²⁶ Ra | ²³² Th | ²³⁸ U |
| <i>Systematic samples^c</i> | | | | | |
| S1 | 6373N,8465E | 0-15 | 0.83±0.1 | 1.1 ±0.1 | 1.1 ±0.6 |
| S2 | 6410N,8470E | 0-15 | 0.82±0.1 | 0.88±0.2 | 1.0 ±0.5 |
| S3A | 6368N,8466E | 0-15 | 0.57±0.07 | 0.66±0.1 | 1.1 ±0.5 |
| S3B | | 15-30 | 0.56±0.07 | 0.86±0.1 | 0.75±0.4 |
| S3C | | 30-45 | 0.60±0.07 | 0.81±0.1 | 0.89±0.3 |
| S4B ^d | 6567N,8467E | 15-30 | 0.59±0.07 | 0.89±0.2 | 0.61±0.1 |
| S4C | | 30-45 | 0.53±0.08 | 0.74±0.1 | 0.86±0.2 |
| S5B ^d | 6368N,8466E | 15-30 | 0.62±0.08 | 0.98±0.2 | 0.81±0.3 |
| S5C | | 30-45 | 0.48±0.07 | 0.71±0.1 | 1.1 ±0.3 |
| S6 | 6365N,8465E | 20-35 | 0.47±0.07 | 0.88±0.2 | 0.42±0.2 |
| S7 | 6382N,8458E | 0-15 | 0.70±0.09 | 1.1 ±0.2 | 1.1 ±0.5 |
| S8 | 6394N,8474E | 0-3 | 0.89±0.07 | 2.7 ±0.2 | 1.3 ±0.4 |
| S9 | 6367N,8463E | 0-15 | 0.92±0.1 | 3.9 ±0.3 | 1.9 ±0.8 |
| <i>Biased samples^{e,f}</i> | | | | | |
| B2 | 6368N,8464E | 0-10 | 0.70±0.09 | 1.4 ±0.2 | 1.2 ±0.4 |
| B3 | 6386N,8472E | 0-10 | 1.1 ±0.1 | 3.9 ±0.3 | 1.6 ±0.4 |
| B4 | 6392N,8482E | 0-15 | 0.75±0.1 | 1.6 ±0.2 | 1.3 ±0.3 |
| B5 ^g | 6367N,8468E | 0-8 | 0.59±0.1 | 0.69±0.2 | 1.2 ±0.5 |
| B7 | 6568N,8465E | 0-8 | 1.5 ±0.1 | 7.8 ±0.4 | <8.4 |

Table 1 (continued)

| Sample number ^a | Grid location | Depth (cm) | Radionuclide concentration (pCi/g) ^b | | |
|----------------------------|---------------|------------|---|-------------------|------------------|
| | | | ²²⁶ Ra | ²³² Th | ²³⁸ U |
| B9A | 6397N,8477E | 0-15 | 1.01±0.1 | 4.0±1.0 | 1.0 ±0.6 |
| B9B | | 15-25 | 0.81±0.1 | 1.4±0.2 | 0.70±0.4 |

^aLocations of soil samples are shown on Fig. 2.

^bIndicated counting error is at the 95% confidence level ($\pm 2\sigma$).

^cSystematic samples are taken at locations irrespective of gamma exposure rates.

^dSurface samples S4A and S5A not taken.

^eSamples B1, B6, and B8 are not included in the table (see text).

^fBiased samples are taken from areas with elevated gamma exposure rates.

^gSample of aggregate and soil taken from underneath driveway.

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