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RADIOLOGICAL SURVEY REPORT FOR THE RESIDENTIAL PROPERTY AT 121 AVENUE F LODI, NEW JERSEY

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TABLE OF CONTENTS

	Page
1.0 Introduction	1
2.0 Survey Methods	1
3.0 Survey Results	3
4.0 Summary	9
References	10

LIST OF FIGURES

Figure	Title	Page
2-1	Locations of Boreholes, Soil Samples, and PIC Measurements at 121 Avenue F	2
3-1	Areas of Elevated Gamma Radiation Levels at 121 Avenue F	8

LIST OF TABLES

Table	Title	Page
3-1	Summary of Applicable Radiation Guidelines for FUSRAP	4
3-2	Background Radiation Levels for the Northern New Jersey Area	5
3-3	Radionuclide Concentrations in Surface Soil at 121 Avenue F	6
3-4	Radionuclide Concentrations in Subsurface Soil at 121 Avenue F	7

1.0 INTRODUCTION

A radiological survey of 121 Avenue F, Lodi, New Jersey was conducted during December 1984 and January 1985 by Bechtel National, Inc. (BNI). This survey was part of the Formerly Utilized Sites Remedial Action Program, a U.S. Department of Energy (DOE) effort to identify, clean up, or otherwise control sites where low-level radioactive contamination (exceeding current guidelines) remains from the early years of the nation's atomic energy program. A screening survey had previously been performed by the Oak Ridge National Laboratory (ORNL) to determine radiological conditions in areas near the Stepan Company (formerly the Maywood Chemical Works) that were suspected of having become contaminated as a result of the thorium and rare earth processing operations at the plant between 1916 and 1956 (Ref. 1). Radiation levels in excess of normal background were identified on several properties during the ORNL survey. DOE requested that BNI perform a characterization survey on those properties and on adjacent properties that BNI personnel suspected of being contaminated. The property at 121 Avenue F is one of the latter.

2.0 SURVEY METHODS

A walk-over scanning survey of the entire property was made using an unshielded 2-in. x 2-in. sodium iodide (NaI) detector (Eberline SPA-3). Concurrently, a 6-ft measurement grid, tied to the state coordinate system, was established, and systematic measurements of the gamma radiation levels were taken at the grid intersections. These measurements were made with a cone-shielded SPA-3 positioned 30 cm above the ground.

The results of the instrument measurements were used to select the locations at which to sample both surface and subsurface soil. These are shown in Figure 2-1. Surface soil samples (0-15 cm) were taken at 10 locations and subsurface soil samples to depths of 5 ft were taken from 12 locations. Boreholes were also logged using the unshielded SPA-3 detector.

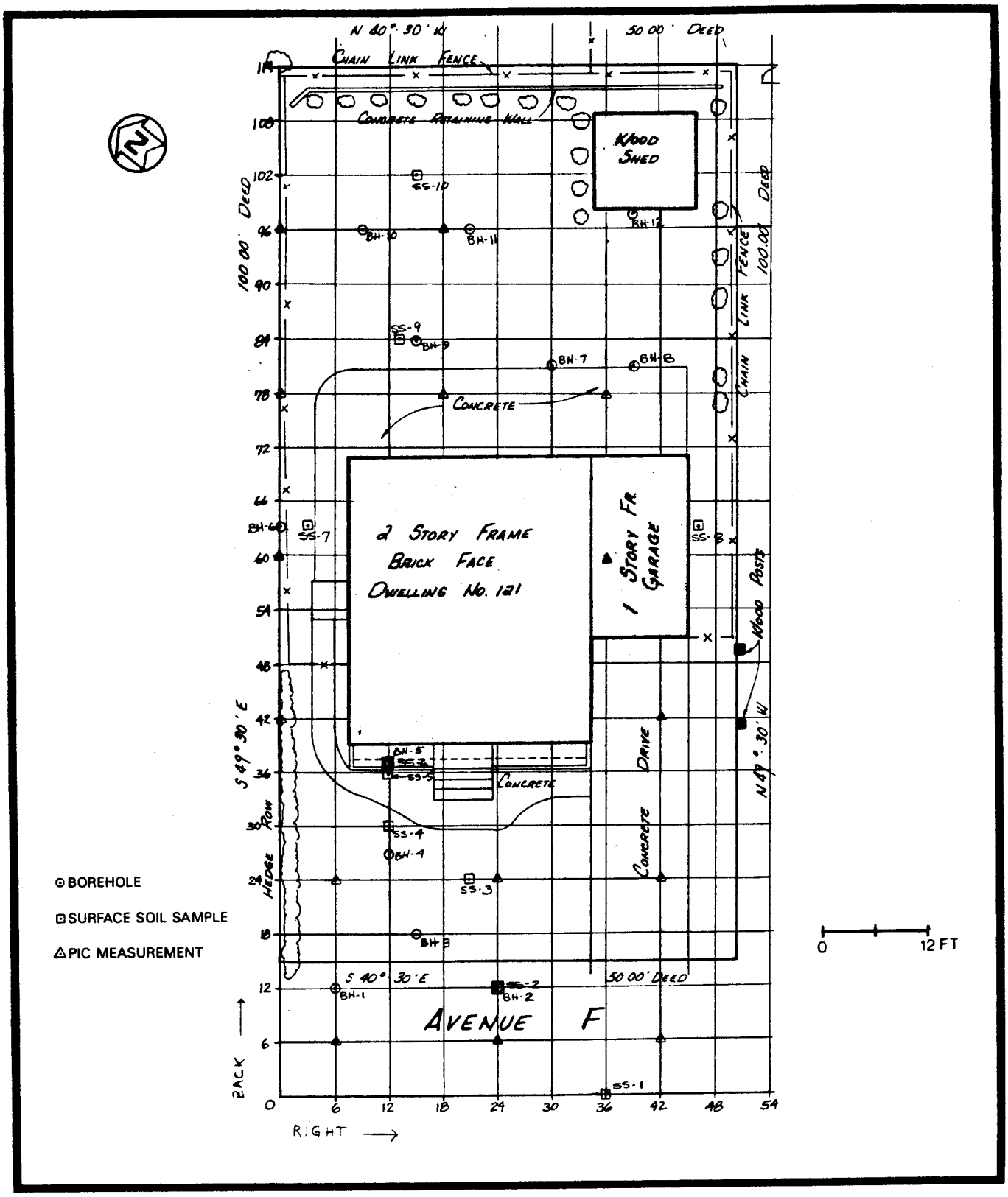

FIGURE 2-1 LOCATIONS OF BOREHOLES, SOIL SAMPLES, AND PIC MEASUREMENTS AT 121 AVENUE F

Pressurized ionization chamber (PIC) measurements of the exposure rate at a height of 1 m above the ground were made at the locations shown in Figure 2-1.

3.0 SURVEY RESULTS

Applicable federal guidelines for external radiation exposure and radionuclide concentrations in soil have been summarized in Table 3-1. The normal background levels for the northern New Jersey area are presented in Table 3-2. These data are provided for comparison with the survey results presented in this section. 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 and Subsurface Soil Samples

Surface and subsurface soil samples were taken from various locations on the property for radionuclide analyses. Locations of the surface samples (SS-#) and subsurface samples (BH-#) are shown in Figure 2-1, with results of laboratory analyses provided in Tables 3-3 and 3-4, respectively. Concentrations of thorium-232 exceeded the DOE remedial action guidelines in seven surface and subsurface samples, indicating that thorium-232-bearing residues are present on this property.

Gamma Radiation Levels

Results of the gamma measurements on this property show areas where gamma exposure rates are in excess of background radiation levels. These areas are shown in Figure 3-1. These results suggest locations of potential thorium-232 contamination. Gamma exposure rate levels up to 18 μR/h were found on this property.

TABLE 3-1

SUMMARY OF APPLICABLE RADIATION GUIDELINES FOR FUSRAP

Exposure Conditions	Guideline Value	Guideline Source
External Gamma Radiation		
Level of gamma radiation at any location on a site to be released for unrestricted use	20 μR/h above background	U.S. DOE Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites (February 1985)
Radionuclide Concentrations in Soil		
Maximum permissible concentration of radium-226 and thorium-232 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	U.S. DOE Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites (February 1985)

TABLE 3-2

BACKGROUND RADIATION LEVELS FOR THE NORTHERN NEW JERSEY AREA

Type of Radiation Measurement or Sample	Radiation Level or Radionuclide Concentrations
Gamma exposure rate at 1 m above floor or ground surface (μR/h)	~8.0[a]
Concentration of radionuclides in soil (pCi/g)	
Thorium-232	0.9[b]
Uranium-238	0.9[b]
Radium-226	0.9[b]

[a]DOE (Ref. 2).

[b]ORNL (Ref. 3).

TABLE 3-3

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL AT 121 AVENUE F

SS-Number	Depth (in.)	Radium-226 (pCi/g)	Thorium-232 (pCi/g)
1	6	0.8	1.8
2	6	None Detected	4.9
3	6	1.5	7.0
4	6	1.3	22.4
5	6	2.1	20.7
6	6	2.3	21.1
7	6	5.4	58.8
8	6	1.6	8.9
9	6	1.0	2.0
10	6	0.9	None Detected

TABLE 3-4

RADIONUCLIDE CONCENTRATIONS IN SUBSURFACE SOIL AT 121 AVENUE F

BH-Number	Depth (ft)	Radium-226 (pCi/g)	Thorium-232 (pCi/g)
1		No soil sample taken	
2	1	1.0	6.6
3	1	1.0	2.3
4	1	0.6	1.0
5	1	4.1	53.6
6	1	<0.9	1.5
7	1	0.8	1.5
8	1	1.4	5.3
9	1	0.7	1.1
10	1	0.8	1.7
11	1	<1.0	2.5
12	1	<0.9	1.5

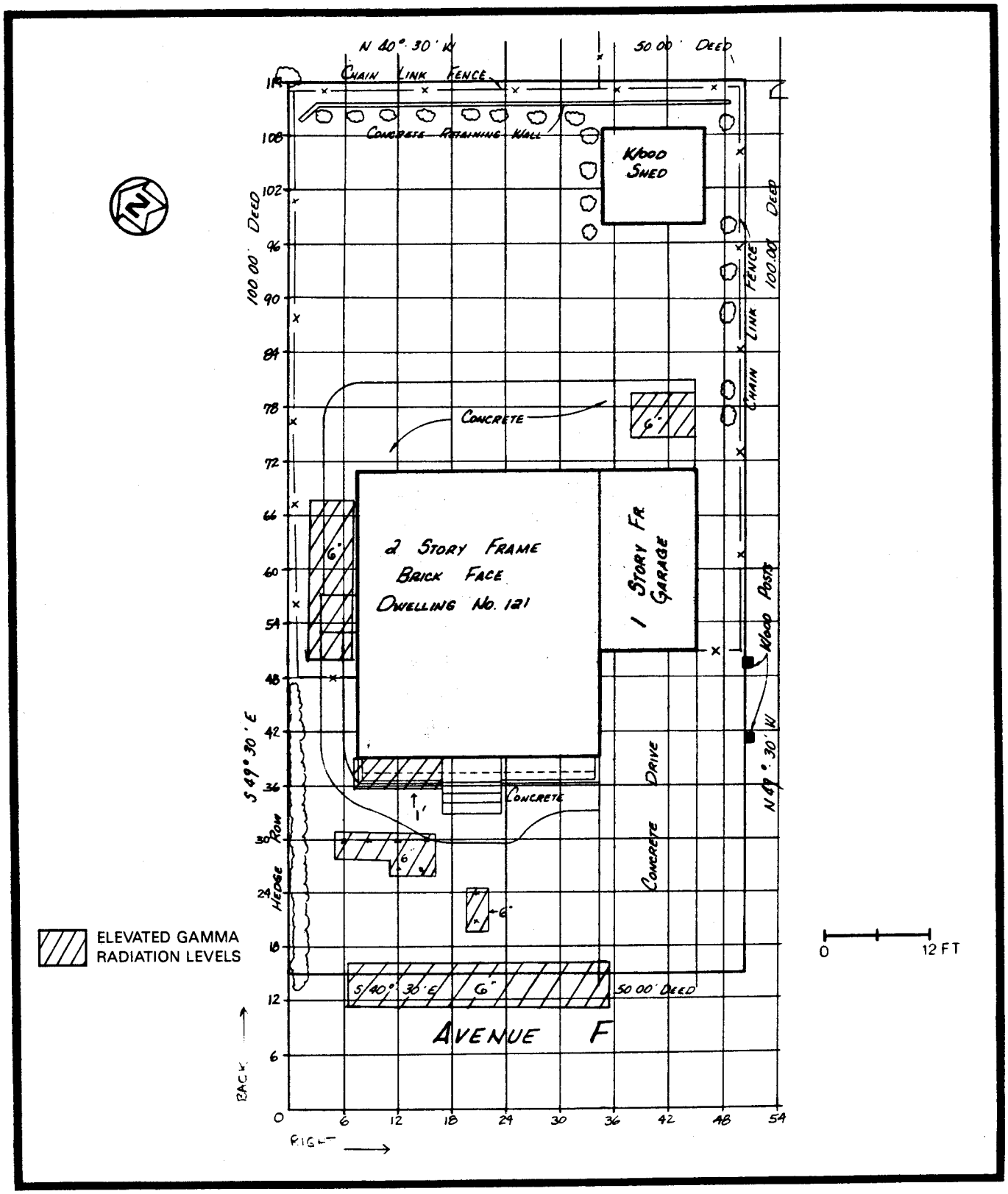

FIGURE 3-1 AREAS OF ELEVATED GAMMA RADIATION LEVELS AT 121 AVENUE F

4.0 SUMMARY

Measurements taken at 121 Avenue F indicate that radioactive contamination is present on the property, primarily from the thorium-232 decay chain and to a lesser extent from the uranium-238 decay chain. This contamination is found in the areas shown in Figure 3-1. Concentrations of radionuclides significantly above background and in excess of DOE guidelines were measured.

REFERENCES

1. Oak Ridge National Laboratory. Results of the Mobile Gamma Scanning Activities in Lodi, New Jersey, ORNL/RASA-8413, Oak Ridge, TN, October 1984.

2. U.S. Department of Energy. Radiological Survey of the Middlesex Municipal Landfill, Middlesex, New Jersey, DOE/EV-0005/20, Oak Ridge, TN, April 1980.

3. Oak Ridge National Laboratory. State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343, Oak Ridge, TN, November 1981.