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Formerly Utilized Sites Remedial Action Program (FUSRAP)  
Contract No. DE-AC05-81OR20722

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**RADIOLOGICAL SURVEY REPORT  
FOR THE RESIDENTIAL PROPERTY  
AT 86 PARK WAY**

**Rochelle Park, New Jersey**

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September 1984



Bechtel National, Inc.  
Advanced Technology Division

2236\*

M-001

DOE/OR/20722-32

RADIOLOGICAL SURVEY REPORT FOR  
86 PARK WAY, ROCHELLE PARK, NEW JERSEY

SEPTEMBER 1984

Prepared for

UNITED STATES DEPARTMENT OF ENERGY  
OAK RIDGE OPERATIONS OFFICE  
Under Contract No. DE-AC05-81OR20722

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TABLE OF CONTENTS

	<u>Page</u>
1.0 Introduction	1
2.0 Survey Methods	1
3.0 Survey Results	4
References	9

## LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1-1	Location of Residential Properties Surveyed on Grove Avenue and Park Way	2
3-1	Area of Elevated Radionuclide Concentrations at 86 Park Way	5
3-2	Locations of Surface Soil Samples and Borehole at 86 Park Way	7

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
1-1	Residual Contamination Guidelines for Formerly Utilized Sites and Remote Surplus Facilities Management Program Sites	3
3-1	Radionuclide Concentrations in Surface Soil, 86 Park Way	8

## 1.0 INTRODUCTION

A radiological survey of 15 residential properties along Grove Avenue and Park Way, Rochelle Park, New Jersey was conducted by Bechtel National, Inc. from November 28 to December 9, 1983. The location of the properties is shown in Figure 1-1. This survey was part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a U.S. Department of Energy (DOE) effort to identify, clean up, or otherwise control sites where low-level radioactive contamination, at concentrations in excess of DOE-approved limits, remains from the early years of the U.S. atomic energy program. The residential properties were suspected of being radioactively contaminated since they adjoin property now owned by Ballod Associates on which surface and subsurface radionuclide concentrations in excess of the DOE guidelines listed in Table 1-1 had been located during earlier surveys by Oak Ridge Associated Universities and Nuclear Safety Associates, Inc. (Refs. 1 and 2). This contamination originated from the processing of thorium ores between 1916 and 1956 by the Maywood Chemical Works (later purchased by Stepan Chemical) and consists primarily of thorium-232 and its daughters with some elevated concentrations of uranium-238 and its daughters.

The primary objective of the 1983 survey was to locate the horizontal and vertical boundaries of radionuclide concentrations exceeding remedial action guidelines. This report describes the survey methods used and readings obtained on the property at 86 Park Way.

## 2.0 SURVEY METHODS

Several radiological survey techniques were used to locate areas of elevated radionuclide concentrations. Surface scans were conducted first to locate and map elevated radiation levels. These measurements were made with an unshielded Eberline SPA-3 scintillation detector held approximately 6 in. from the ground

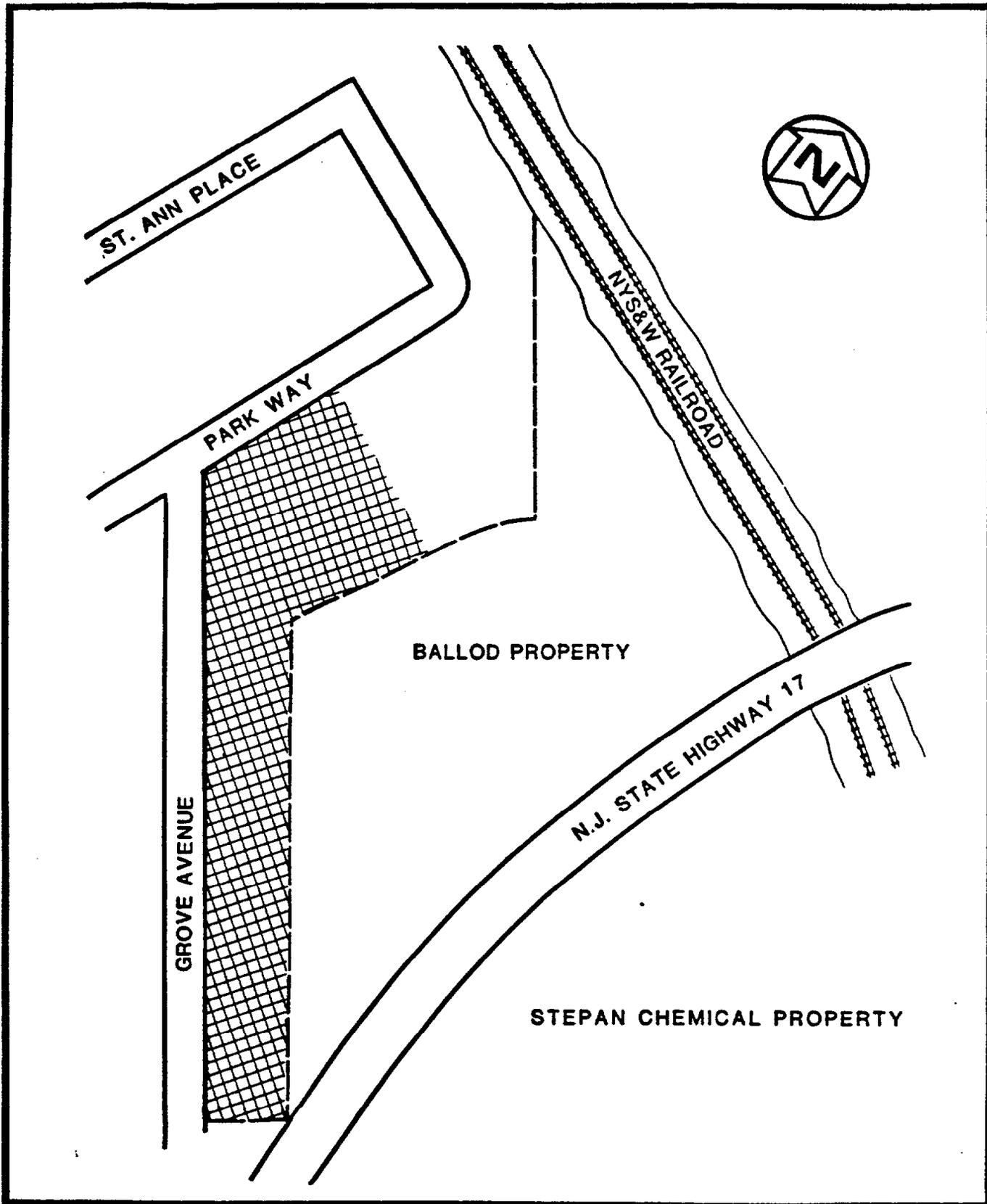


FIGURE 1-1 LOCATION OF RESIDENTIAL PROPERTIES SURVEYED ON GROVE AVENUE AND PARK WAY

TABLE 1-1  
RESIDUAL CONTAMINATION GUIDELINES FOR FORMERLY UTILIZED  
SITES AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES<sup>a</sup>

Radionuclide	Concentration in Soil (pCi/g above background) <sup>b,c,d</sup>
Natural Uranium <sup>e</sup>	75
Uranium-238 <sup>f</sup>	150
Radium-226 Thorium-230 <sup>g</sup> Thorium-232 <sup>g</sup>	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.

<sup>a</sup>Adapted from DOE (Ref. 3).

<sup>b</sup>In the event of occurrence of mixtures of radionuclides, the fraction contributed by each radionuclide to its guideline shall be determined, and the sum of these fractions shall not exceed 1. If both thorium-230 and radium-226 are present, only the one present in the highest concentration should be included in the sum. If the radium-226 concentration exceeds the thorium-230 concentration, the sum shall be evaluated by replacing the radium-226 concentration with the difference between the radium-226 and thorium-230 concentrations.

<sup>c</sup>These guidelines represent unrestricted-use residual concentrations above background averaged across any 15-cm-thick layer to any depth and over any contiguous 100-m<sup>2</sup> surface area.

<sup>d</sup>Localized concentrations in excess of these limits are allowable provided that the average over 100 m<sup>2</sup> is not exceeded. Localized elevated concentrations will be dealt with on a site-specific basis.

<sup>e</sup>A curie of natural uranium means the sum of 3.7 x 10<sup>10</sup> dis/s over any 15-cm-thick layer from uranium-238 plus 3.7 x 10<sup>10</sup> dis/s from uranium-234 plus 1.7 x 10<sup>5</sup> dis/s from uranium-235. One curie of natural uranium is equivalent to 3,000 kg or 6,600 lb of natural uranium.

<sup>f</sup>Assumes that no other uranium isotopes are present.

<sup>g</sup>The thorium-230 and thorium-232 guidelines are to account for ingrowth of radium-226 and radium-228, respectively as thorium-230 and thorium-232 decay. Radium-226 and radium-228 are limiting radionuclides because their decay products are radon and thoron gas.

during a walk-over of the entire area. Concurrently, measurements were taken at 25-ft intervals on the premarked 50-ft grid. At each point, 1-minute counts were made at the ground surface with an Eberline HP-210T probe and at an elevation of 1 ft with a cone-shielded SPA-3. All measurements in excess of twice background were noted and these areas marked. Borehole and surface soil sample locations were selected to best define the extent of the contamination as well as the radionuclide content of the soil on each property. The borehole was drilled to a depth of 4 ft and the radiation levels at various depths within it were logged using a scintillator to detect gamma emissions from soil contaminants. The borehole logging data indicate the approximate depths of contamination. Evaluation of the borehole logs suggested locations at which to take Shelby tube cores of undisturbed soil to obtain a more accurate depth profile of the radionuclide content of the soil. Collection of surface samples consisted of removing a 6-in.-diameter by 6-in.-deep section of soil. The soil was mixed and homogenized before analysis.

Soil samples were analyzed for uranium-238, radium-226, and thorium-232. Preliminary analysis consisted of gamma spectroscopy of wet samples. Samples that indicated elevated levels in the preliminary analysis were dried, ball-milled, and recounted.

Pressurized ionization chamber (PIC) readings were taken 3 ft above ground surface to measure the exposure rate.

### 3.0 SURVEY RESULTS

During the walk-over survey of this property elevated readings were detected in an area of approximately 140 ft<sup>2</sup> in the center of the backyard, as shown in Figure 3-1.

The gamma exposure rate measurement obtained at the rear of the property was 12.8  $\mu$ R/h. The limit for exposure of the general

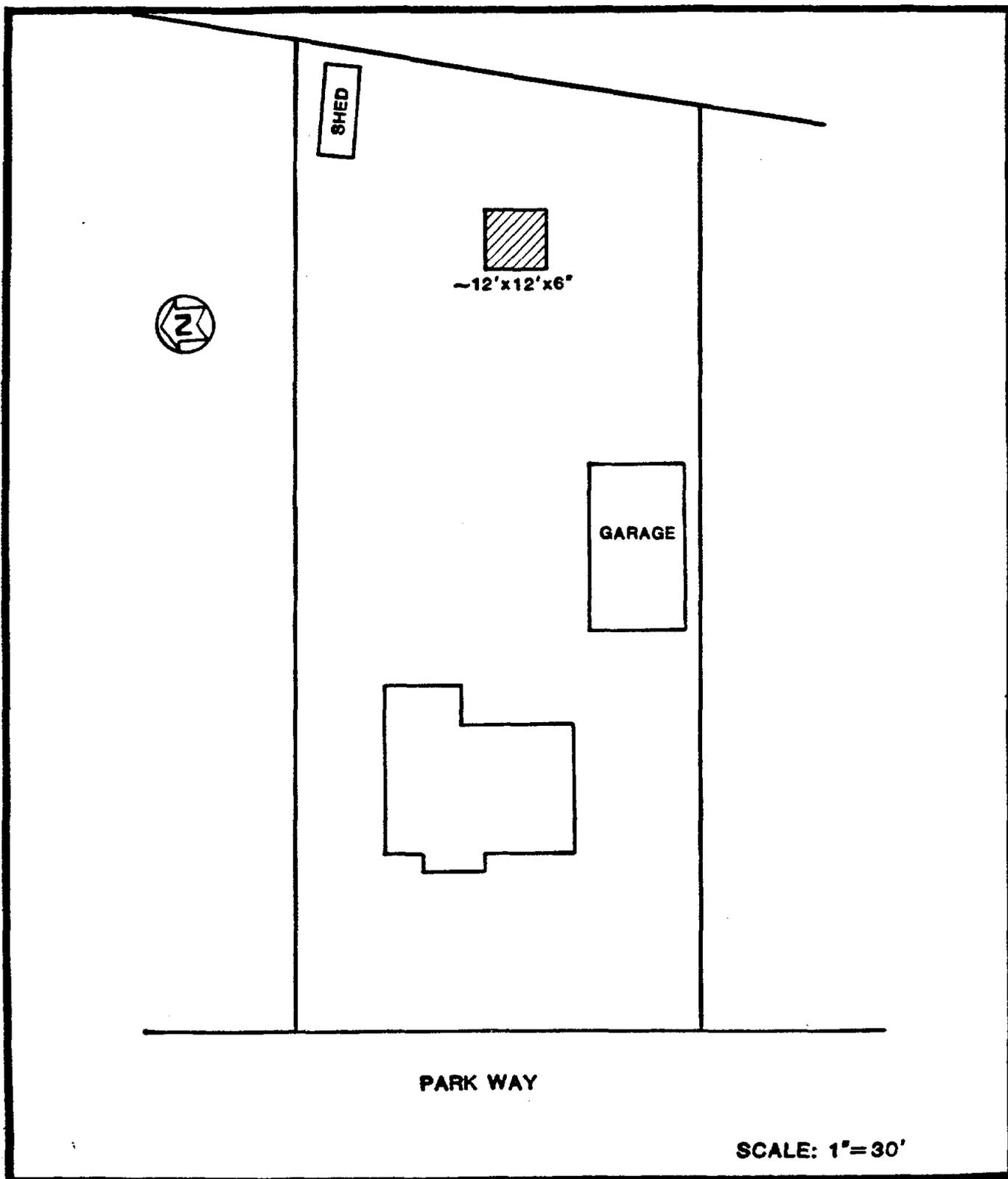


FIGURE 3-1 AREA OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 86 PARK WAY

public established by the Nuclear Regulatory Commission in 10 CFR 20.105 is 500 mrem/yr (Ref. 4). If exposure is assumed to be continuous, this value corresponds to 60  $\mu$ R/h.

Five surface soil samples were collected from the southeastern section and center of the backyard, as shown in Figure 3-2. Results of the laboratory analyses of the samples are presented in Table 3-1.

Surface sampling and the gamma log of the borehole indicated that contamination is confined to the upper 6 inches of soil. Field observation suggested that the contamination is a shallow deposit probably created by runoff from the Ballod property. Near-surface (0.5 to 1.0 in. deep) radionuclide concentrations may be more than an order of magnitude higher than those found when the concentrations are averaged over a depth of 6 inches.

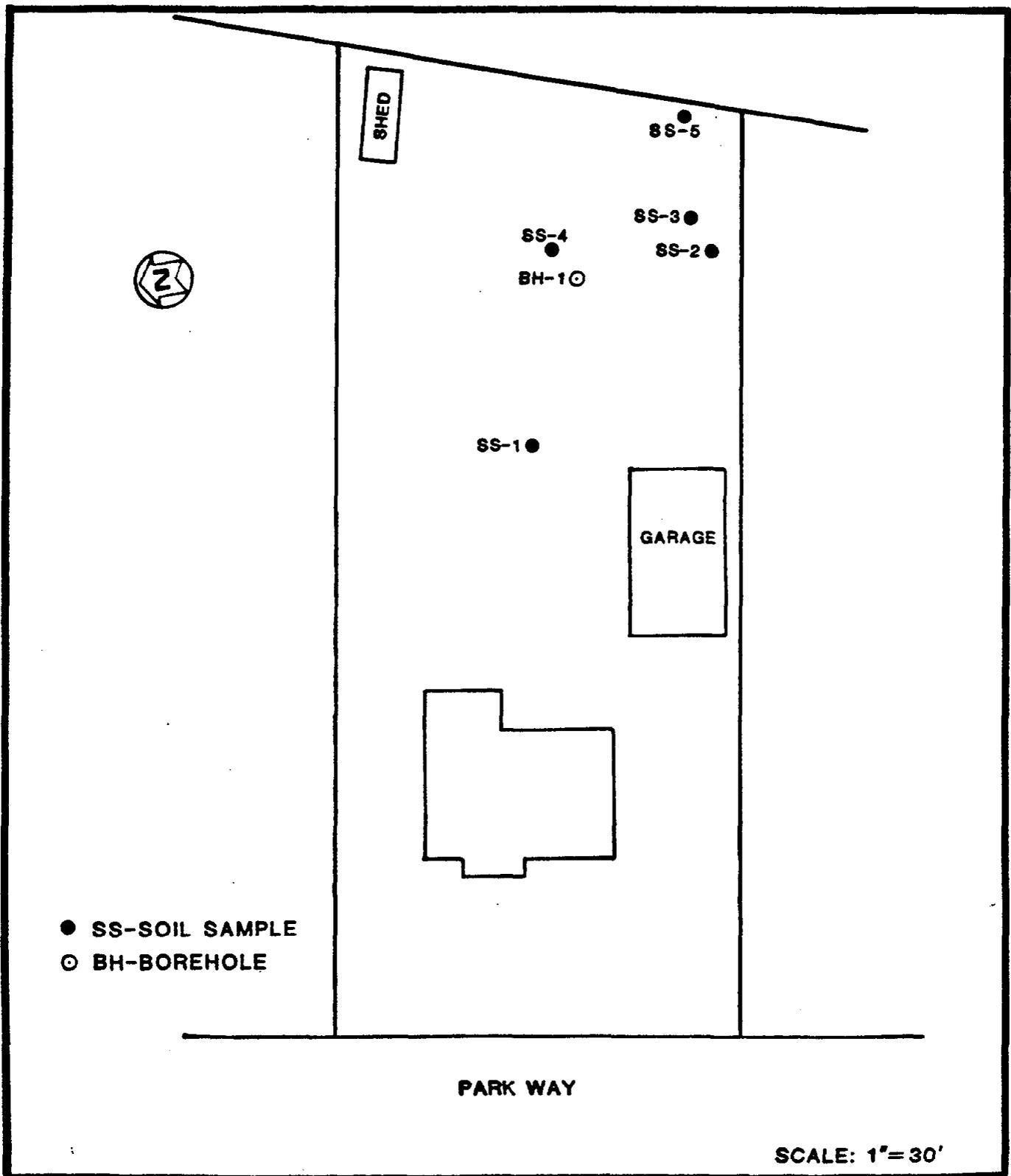


FIGURE 3-2 LOCATIONS OF SURFACE SOIL SAMPLES AND BOREHOLE AT 86 PARK WAY

TABLE 3-1  
RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 86 PARK WAY  
(picocuries per gram)

<u>Number</u>	<u>Location</u>	<u>Uranium 238</u>	<u>Radium 226</u>	<u>Thorium 232</u>
SS-1 <sup>a</sup>	N9100, E8850	PNP	1.0	2.3
SS-2 <sup>b</sup>	N9100, E8904	18.0	2.1	6.8
SS-3 <sup>a</sup>	N9110, E8908	PNP	1.4	PNP
SS-4 <sup>a</sup>	N9118, E8886	PNP	1.8	4.6
SS-5 <sup>a</sup>	N9117, E8921	15.9	0.7	5.9

<sup>a</sup>Count of wet sample corrected for nonhomogeneity, attenuation, and source geometry.

<sup>b</sup>Sample dried, ball-milled, and recounted.

PNP Peak Not Present

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3. U.S. Department of Energy. "Interim Residual Contamination and Waste Control Guidelines for Formerly Utilized Sites Remedial Action Program (FUSRAP) and Remote Surplus Facilities Management Program (SFMP) Sites" (draft), April 1984.
4. U.S. Code of Federal Regulations. 10 CFR 20.105, "Permissible Levels of Radiation in Unrestricted Areas," Washington, DC, January 1983.