DOE/OR/20722-37

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

RADIOLOGICAL SURVEY REPORT FOR THE RESIDENTIAL PROPERTY AT 22 GROVE AVENUE

Rochelle Park, New Jersey

September 1984

Bechtel National, Inc.
Advanced Technology Division

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RADIOLOGICAL SURVEY REPORT FOR 22 GROVE AVENUE, ROCHELLE PARK, NEW JERSEY

SEPTEMBER 1984

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

Bechtel National, Inc.

Advanced Technology Division

Oak Ridge, Tennessee

Bechtel Job No. 14501

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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 22 Grove Avenue.

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

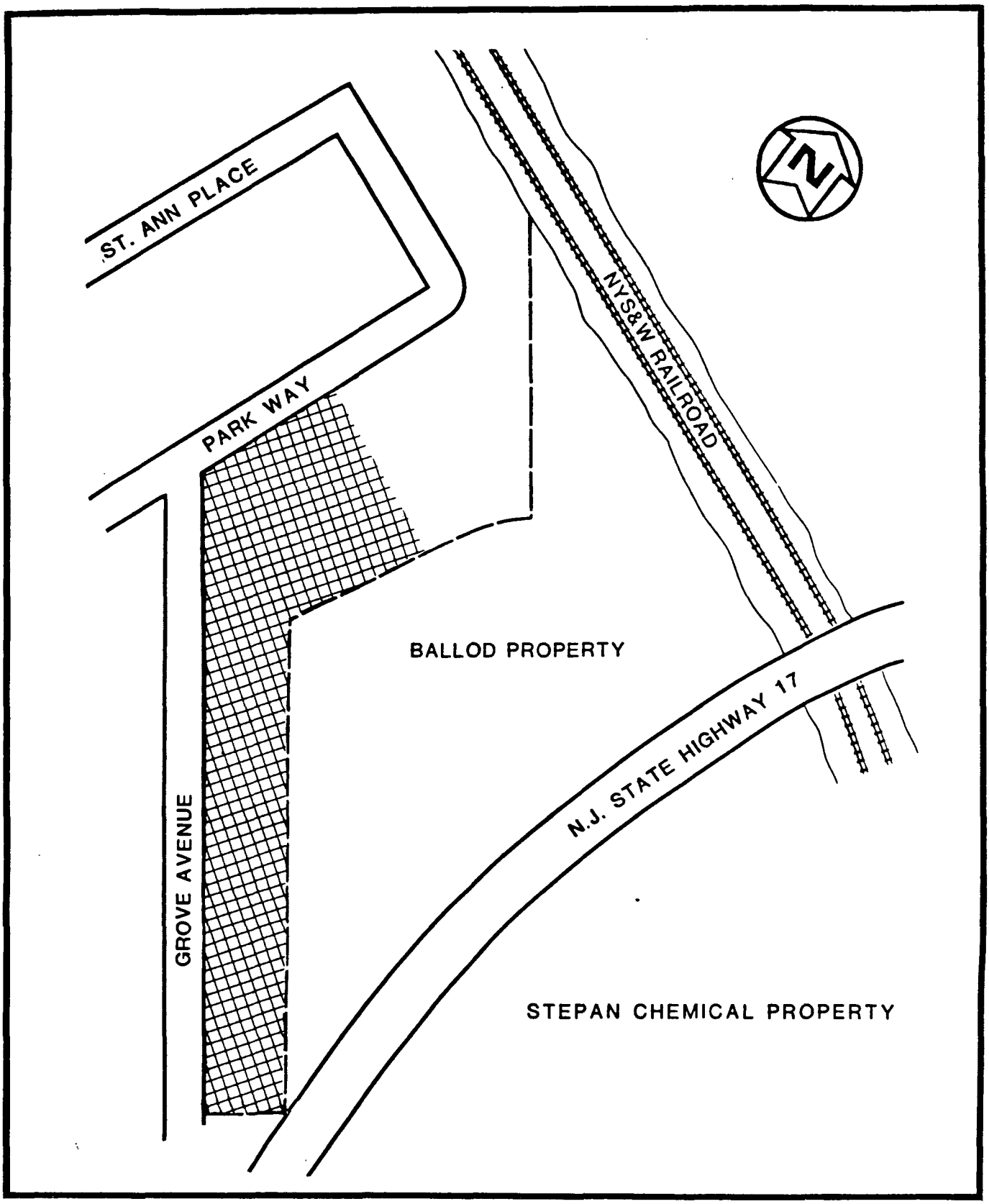

FIGURE 1-1 LOCATION OF RESIDENTIAL PROPERTIES SURVEYED ON GROVE AVENUE AND PARK WAY

TABLE 1-1

RESIDUAL CONTAMINATION GUIDELINES FOR FORMERLY UTILIZED SITES AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES[a]

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

[a]Adapted from DOE (Ref. 3).

[b]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.

[c]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^2 surface area.

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

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

[f]Assumes that no other uranium isotopes are present.

[g]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.

3.0 SURVEY RESULTS

During the walk-over survey of this property moderately elevated readings were detected in an area of approximately 200 ft^2 in the northeastern corner, as shown in Figure 3-1.

Five surface soil samples and one subsurface Shelby tube sample were collected from six locations on the property, as shown in Figure 3-2. Results of the laboratory analyses of the samples are presented in Tables 3-1 and 3-2.

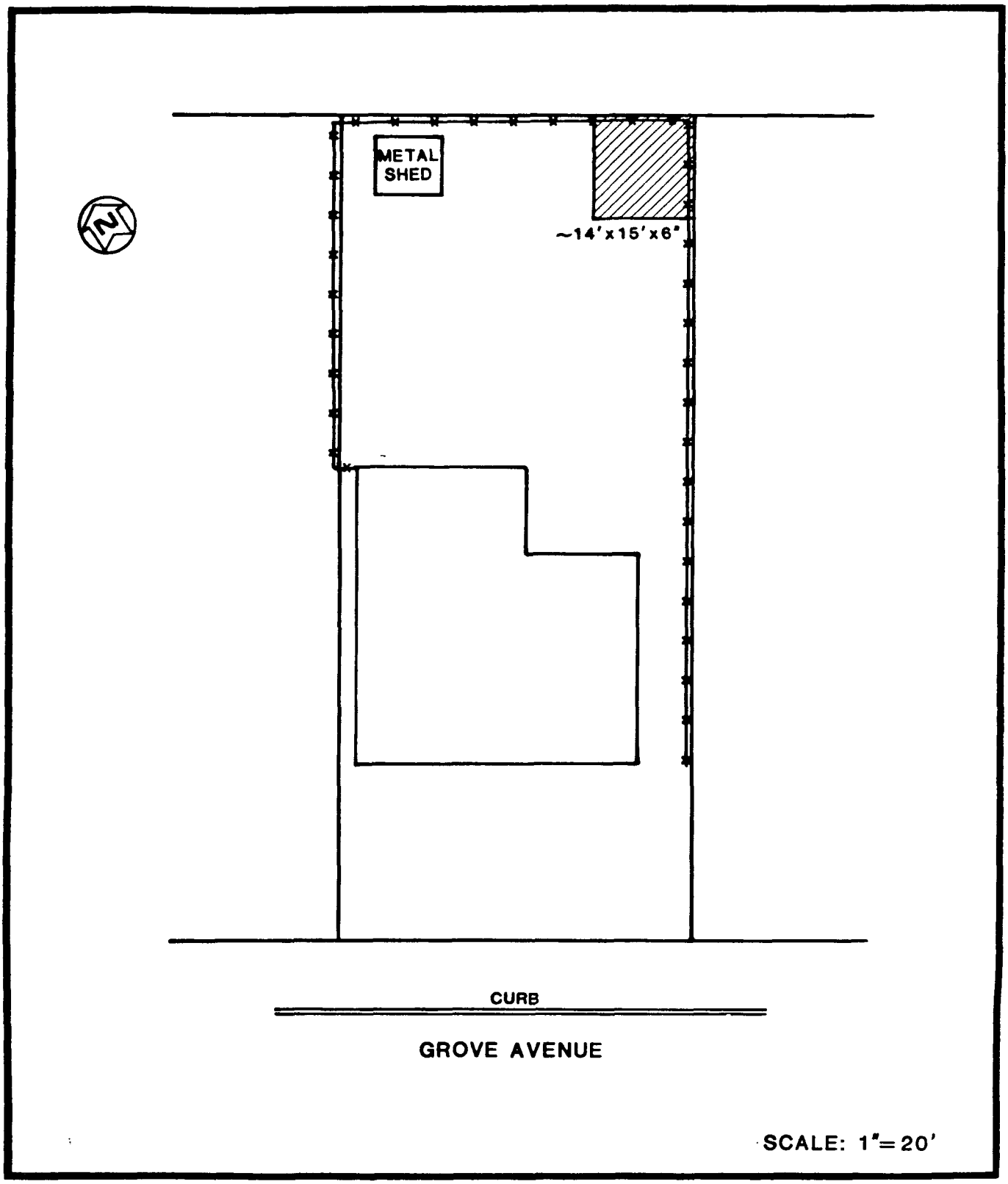

FIGURE 3-1 AREA OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 22 GROVE AVENUE

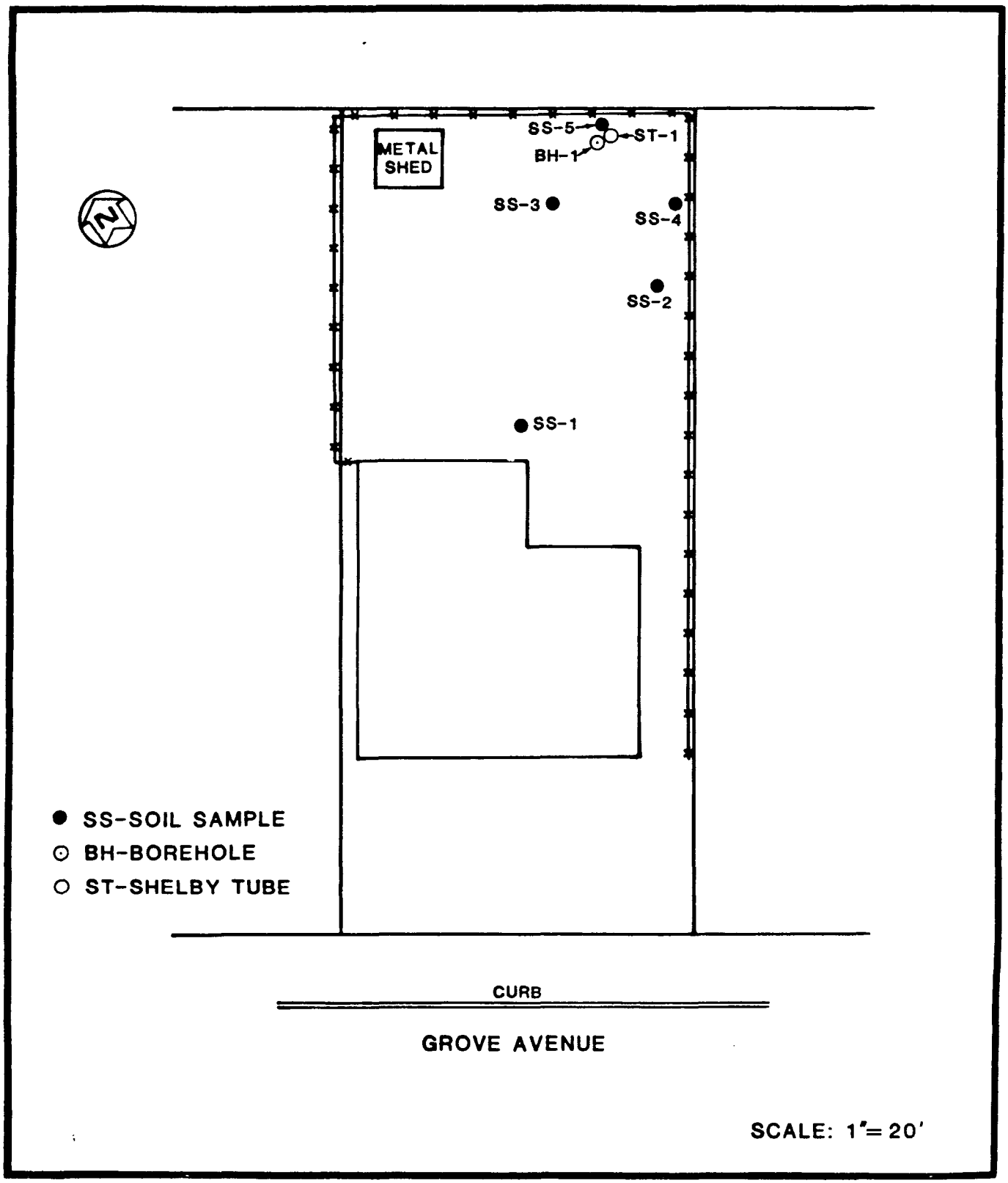

FIGURE 3-2 LOCATIONS OF SURFACE SOIL SAMPLES, BOREHOLE, AND SHELBY TUBE CORE SAMPLE AT 22 GROVE AVENUE

TABLE 3-1

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 22 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8960, E9100	PNP	0.8	PNP
SS-2[a]	N8980, E9120	PNP	PNP	PNP
SS-3[a]	N8992, E9107	PNP	PNP	2.5
SS-4[b]	N8992, E9124	29.9	3.3	16.1
SS-5[a]	N8997, E9115	22.7	2.2	13.8

[a]Count of wet sample corrected for nonhomogeneity, attenuation, and source geometry.

[b]Sample dried, ball-milled, and recounted.

PNP Peak Not Present

TABLE 3-2

RADIONUCLIDE CONCENTRATIONS IN SUBSURFACE SOIL, 22 GROVE AVENUE

(picocuries per gram)

Number/ Location	Depth (Inches)	Uranium 238	Radium 226	Thorium 232
ST-1/ N8996, E9115	0-6[a]	PNP	0.3	5.0
	6-12[a]	PNP	0.8	2.5
	12-18[a]	7.8	0.6	0.9
	18-25[a]	PNP	0.9	0.8

[a]Count of wet sample corrected for nonhomogeneity, attenuation, and source geometry.

PNP Peak Not Present

Surface and subsurface sampling indicated that contamination is confined to the upper few inches of soil. Field observation suggested that the contamination is a shallow deposit probably created by runoff from the Ballod property.

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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.