M-684

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the Maywood Site, New Jersey

US Army Corps of Engineers®

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DOE/OR/20722-11

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

RADIOLOGICAL SURVEY REPORT FOR MAYWOOD VICINITY PROPERTIES ON GROVE AVENUE AND PARK WAY

Maywood, New Jersey

June 1984

Bechtel National, Inc.
Advanced Technology Division

DOE/OR/20722-11

RADIOLOGICAL SURVEY REPORT FOR MAYWOOD VICINITY PROPERTIES ON GROVE AVENUE AND PARK WAY MAYWOOD, NEW JERSEY

JUNE 1984

Prepared for

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By
Bechtel National, Inc.
Advanced Technology Division
Oak Ridge, Tennessee

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1.0 INTRODUCTION

A radiological survey of 15 residential properties along Grove Avenue and Park Way, Maywood, 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 levels above current guidelines, 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 criteria 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 criteria.

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 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-min counts were made at the ground

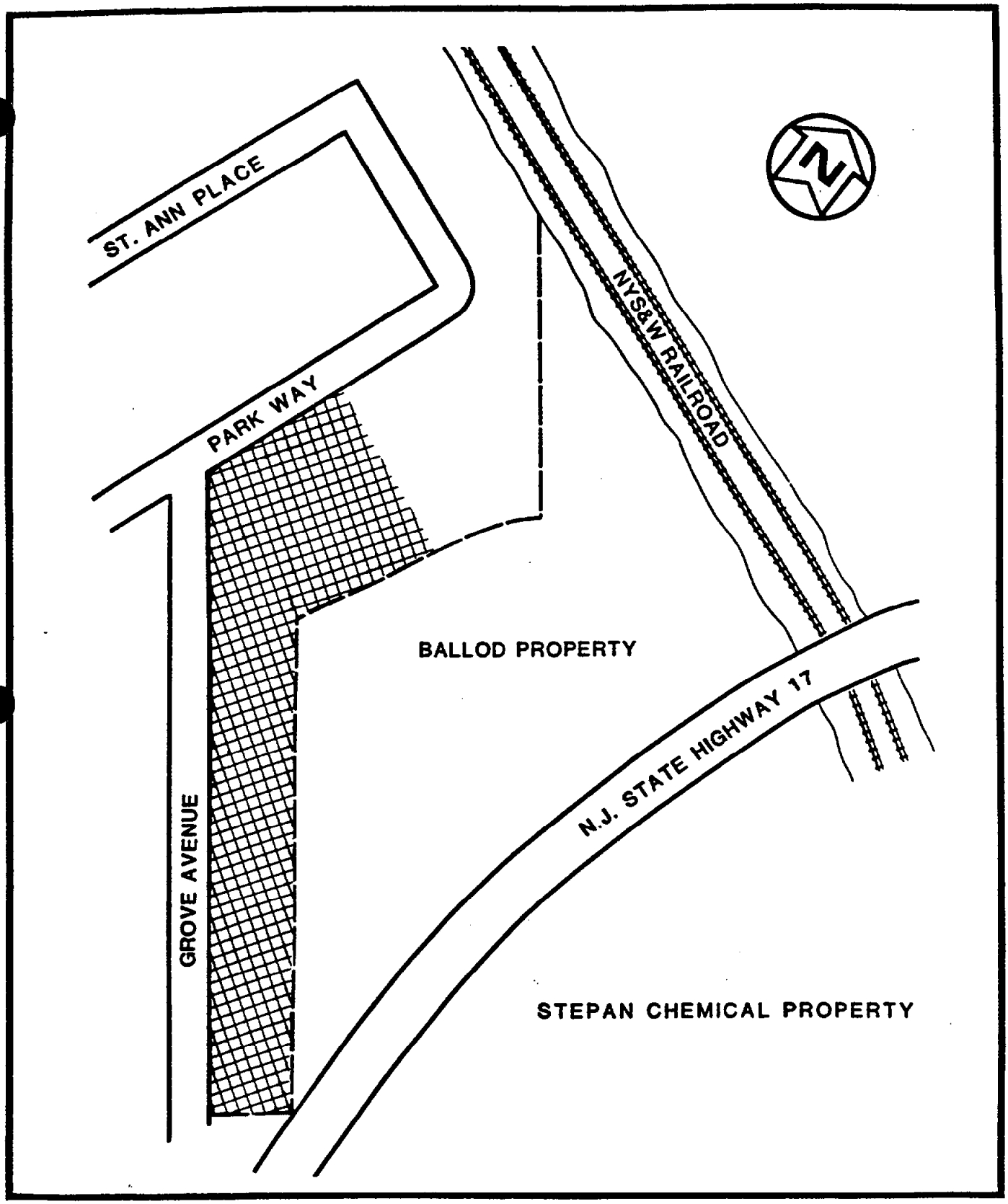

FIGURE 1-1 LOCATION OF RESIDENTIAL PROPERTIES SURVEYED ON GROVE AVENUE AND PARK WAY

TABLE 1-1

RESIDUAL CONTAMINATION CRITERIA FOR FORMERLY UTILIZED

SITES AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES

Radionuclide	Soil Criteria pCi/g above background[1,2,3]
Natural Uranium	75
A curie of natural uranium means the sum of 3.7×10^{10} dis/s 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.	
Uranium-238	150
Assumes that no other uranium isotopes are present.	
Radium-226	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 and less than 1.5 m below the surface.
Thorium-230	15
The thorium-230 guideline is 15 pCi/g to account for ingrowth of radium-226 as thorium-230 decays. Radium-226 is a limiting radionuclide because its decay product is radon-222 gas.	
Thorium-232	15

[1] In the event of occurrence of mixtures of radionuclides, the fraction contributed by each radionuclide to its limit shall be determined, and the sum of these fractions shall not exceed 1. If radium-226 is present, then the fraction for radium-226 should not be included in the sum if the radium-226 concentration is less than or equal to the thorium-230 concentration. If the radium-226 concentration exceeds the thorium-230 concentration, then the sum shall be evaluated by replacing the radium-226 concentration by the difference between the radium-226 and the thorium-230 concentrations.

[2] Except for radium-226, these criteria 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. The same conditions prevail for radium-226 except for soil layers beneath 1.5 m, the allowable radium-226 concentration may be affected by site-specific conditions and must be evaluated accordingly.

[3] Localized concentrations in excess of these limits are allowable provided that the average over 100 m^2 is not exceeded.

Source: Ref. 3

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. The walk-over scan located several areas with external radiation levels somewhat above background. Borehole and surface soil sample locations were selected accordingly to best define the extent of the contamination as well as the radionuclide content of the soil. Boreholes were drilled to a depth of 4 ft and the radiation levels at various depths within them 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. It has been shown empirically that multiplying values obtained from wet sample analysis by a factor of two more closely approximates actual concentrations. Nonhomogeneity, attenuation, and source geometry of the wet sample account for the discrepancy in concentration values. Samples that indicated elevated levels in the preliminary analysis were dried, ball-milled, and recounted. Concentrations presented in this report are the corrected and recounted values.

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

3.0 SUMMARY OF RESULTS

The general results of this radiological survey are summarized below. Detailed results for each of the residential properties surveyed are given in Section 4.0.

The average of the eight PIC measurements of the external exposure rate was 14.1 μR/h (microroentgens per hour) and the range was from 8.1 to 18.8 μR/h. The natural background level in New Jersey ranges from 2.3 to 13 μR/h with an average of 6.1 μR/h (Ref. 4).

Thorium-232, radium-226, and uranium-238 concentrations in surface and subsurface soil samples taken from the 15 properties investigated are reported in the appropriate tables in Section 4.0; locations of surface soil samples, boreholes, and Shelby tube core samples are shown in the associated figures.

Field observations and a review of the data show that elevated radionuclide concentrations are generally confined to low-lying areas. This indicates with good probability that low-level contamination has migrated onto the properties via surface drainage of rainwater from the adjacent Ballod property. The elevated levels rarely extend to depths greater than 6 in. and are usually found only within the first few inches of soil.

The elevated radionuclide concentrations on the surveyed properties do not exceed applicable residual contamination criteria for the Formerly Utilized Sites Remedial Action Program. Although several individual analyses are above the criterion limit, no contiguous 100-m^2 (approximately 1,000 ft^2) area has an average radionuclide concentration in excess of the maximum residual contamination limits for unrestricted use of land. However, remedial action may be appropriate for 8 of the 15 properties for three reasons.

First, given the mechanism by which radionuclide deposition occurred on these properties, samples taken from only the first few inches of soil could indicate concentrations significantly higher than those obtained from the 6-in. sampling depth utilized in this survey. Second, these are residential properties and the ease with which decontamination could be accomplished would appear to be compatible with the as low as reasonably achievable (ALARA) philosophy and the research and development aspects of this program. Third, residents of these properties are well aware of the radioactive contamination on the adjacent Ballod property and its potential for migration onto their land. Several residents have expressed concern over the possible health hazards of this contamination.

The estimate of the contaminated soil volume from all the properties is approximately 100 yd^3. Areas exhibiting elevated radionuclide concentrations are delineated in the figures in Section 4.0.

4.0 RESULTS FOR INDIVIDUAL PROPERTIES

Results for each property surveyed are provided in the following subsections.

4.1 RESULTS FOR 80 PARK WAY

Surveys and soil analyses as described in Section 2.0 were conducted on the property located at 80 Park Way. No elevated readings were detected during the walk-over survey.

A surface soil sample was obtained from one location on the property, as shown in Figure 4-1. The result of the laboratory analysis of the sample is presented in Table 4-1.

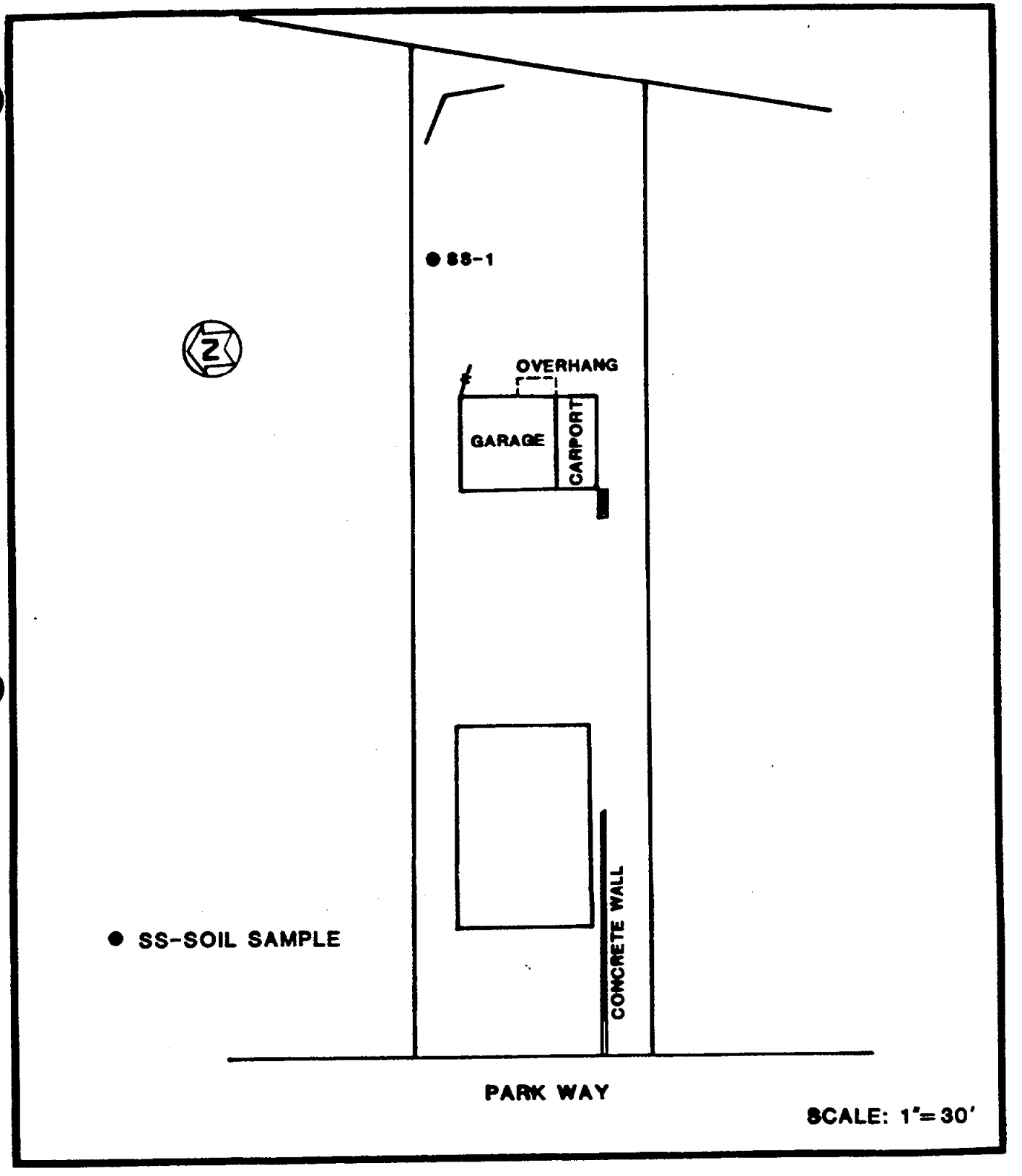

FIGURE 4-1 LOCATION OF SURFACE SOIL SAMPLE AT 80 PARK WAY

TABLE 4-1

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 80 PARK WAY

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N9200, E8850	PNP	0.8	PNP

[a]Preliminary count of wet sample

PNP Peak Not Present

4.2 RESULTS FOR 86 PARK WAY

Surveys and analyses as described in Section 2.0 were conducted on the property located at 86 Park Way.

During the walk-over survey elevated readings were detected in an area of approximately 140 ft^2 in the center of the backyard, as shown in Figure 4-2A.

The gamma exposure rate measurement obtained at the rear of the property was 12.8 µR/h. The limit for exposure of the general public established by the Nuclear Regulatory Commission in 10 CFR 20.105 is 500 mrem/yr (Ref. 5). If exposure is assumed to be continuous, this value corresponds to 60 µR/h.

Five surface soil samples were collected from the southeastern section and center of the backyard, as shown in Figure 4-2B. Results of the laboratory analyses of the samples are presented in Table 4-2A.

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.

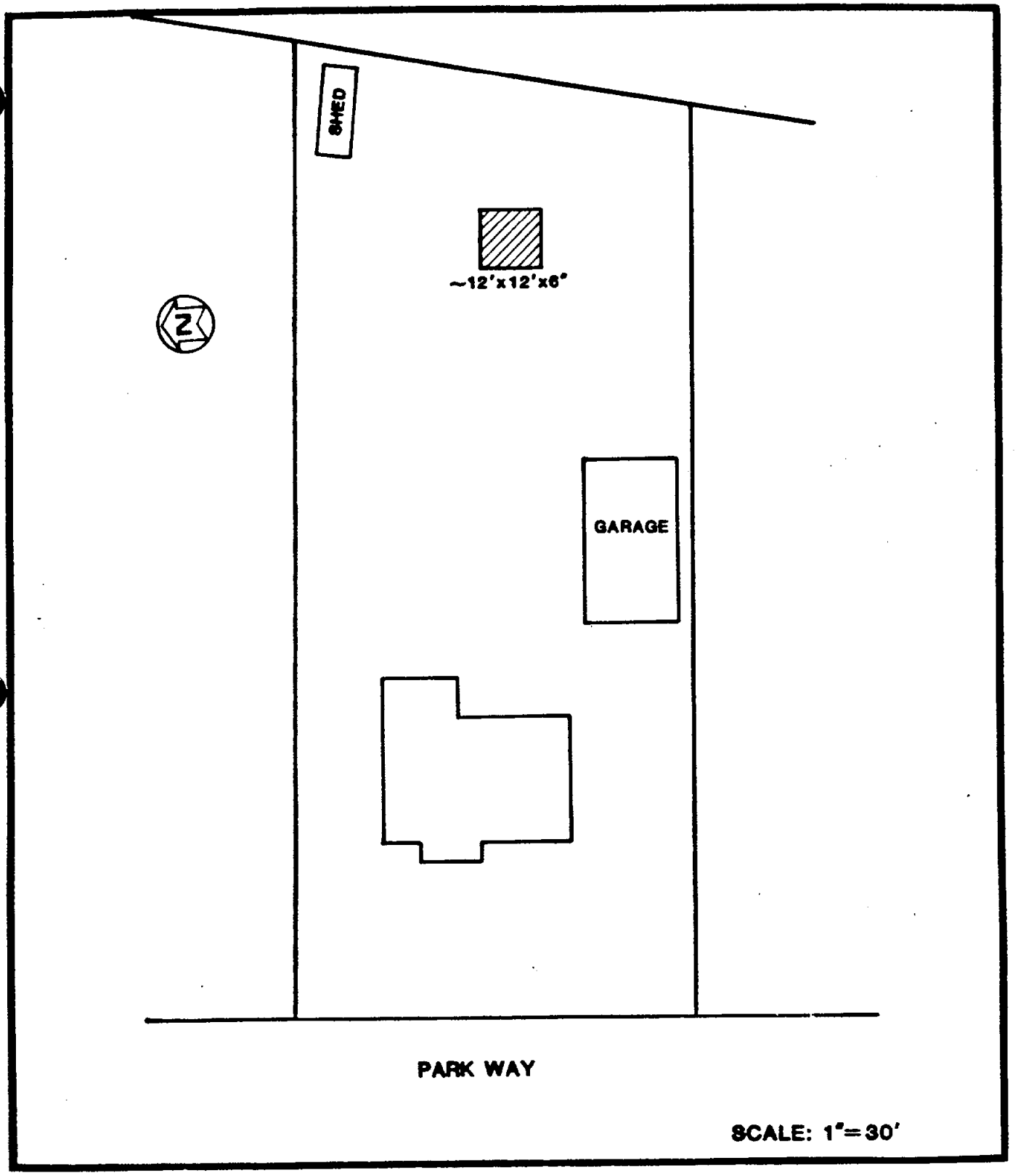

FIGURE 4-2A AREA OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 86 PARK WAY

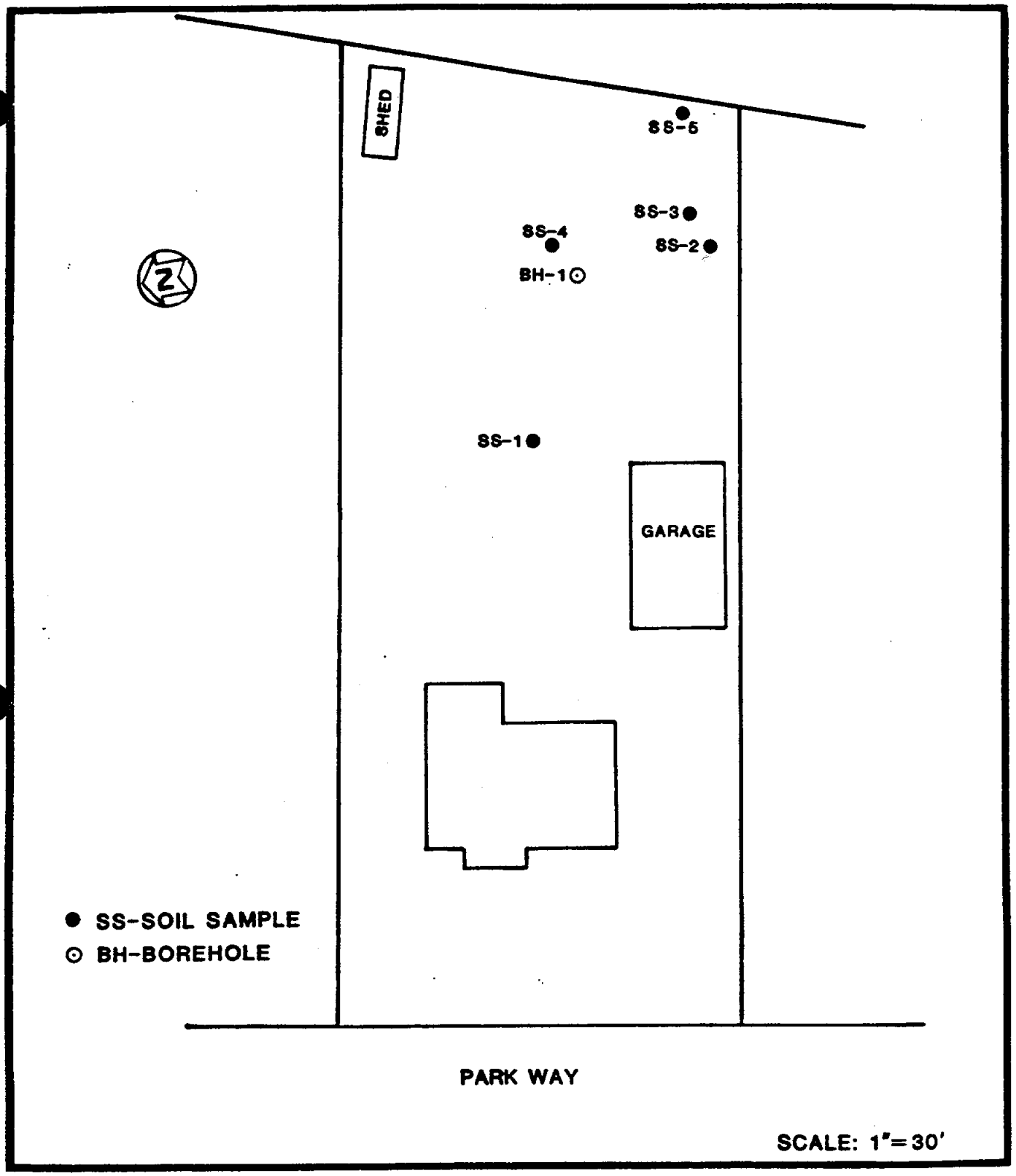

FIGURE 4-2B LOCATIONS OF SURFACE SOIL SAMPLES AND BOREHOLE AT 86 PARK WAY

TABLE 4-2

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 86 PARK WAY

(picocuries per gram)

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

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled, and recounted

PNP Peak Not Present

4.3 RESULTS FOR 90 PARK WAY

Surveys and analyses as described in Section 2.0 were conducted on the property located at 90 Park Way.

During the walk-over survey elevated readings were detected in three areas totalling approximately 1150 ft^2, as shown in Figure 4-3A.

The gamma exposure rate measurement obtained at the rear of the property was 18.8 μR/h. The limit for exposure of the general public established by the Nuclear Regulatory Commission in 10 CFR 20.105 is 500 mrem/yr (Ref. 5). If exposure is assumed to be continuous, this value corresponds to 60 μR/h.

Ten surface soil samples and one subsurface Shelby tube sample were collected from 11 locations on the property, as shown in Figure 4-3B. Results of the laboratory analyses of the samples are presented in Tables 4-3A and 4-3B.

Surface and subsurface sampling 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. Radionuclide concentrations on the surface may be significantly higher than those found in the upper 6 inches of soil.

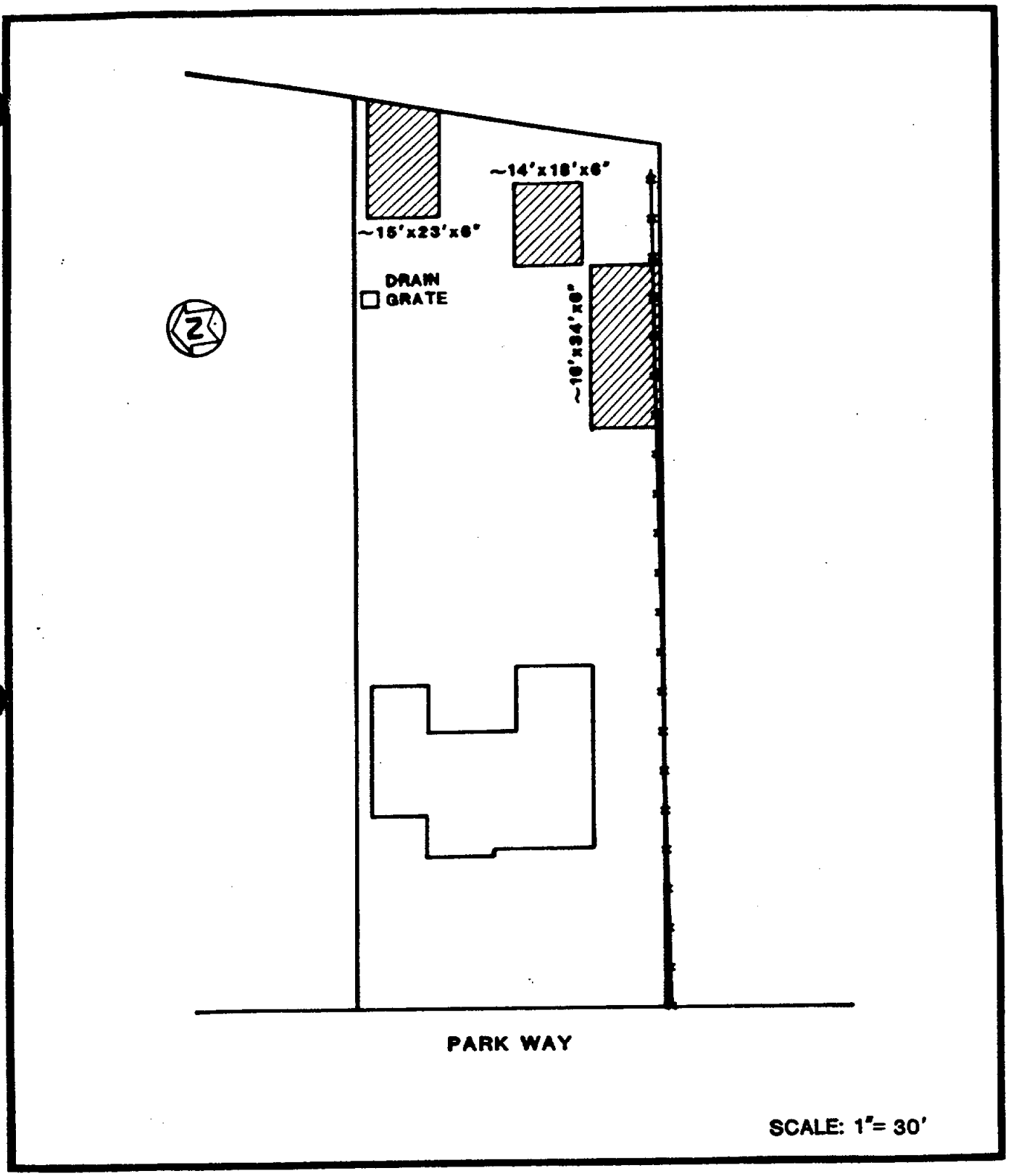

FIGURE 4-3A AREAS OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 90 PARK WAY

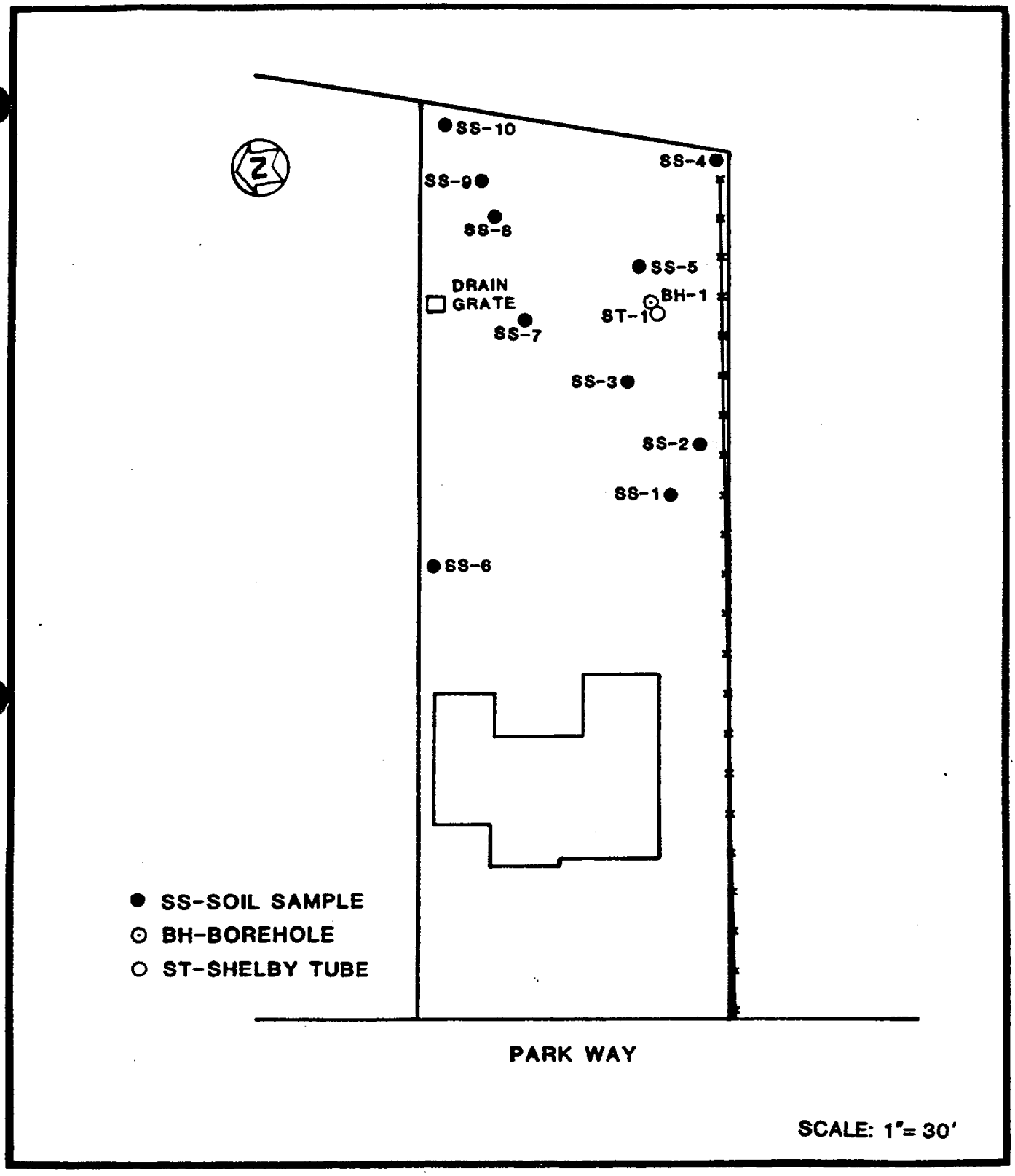

FIGURE 4-3B LOCATIONS OF SURFACE SOIL SAMPLES, BOREHOLE, AND SHELBY TUBE CORE SAMPLE AT 90 PARK WAY

TABLE 4-3A

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 90 PARK WAY

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N9010, E8889	PNP	1.2	1.9
SS-2[b]	N9010, E8900	20.6	0.9	10.1
SS-3[a]	N9033, E8906	PNP	0.6	PNP
SS-4[a]	N9037, E8953	PNP	1.4	PNP
SS-5[b]	N9044, E8926	23.8	2.1	8.0
SS-6[a]	N9050, E8850	PNP	1.2	3.0
SS-7[a]	N9060, E8908	PNP	2.0	6.0
SS-8[a]	N9075, E8914	PNP	2.4	4.8
SS-9[a]	N9086, E8918	3.4	0.9	3.0
SS-10[b]	N9100, E8928	3.7	2.3	5.5

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled, and recounted

PNP - Peak Not Present

TABLE 4-3B

RADIONUCLIDE CONCENTRATIONS IN SUBSURFACE SOIL, 90 PARK WAY

(picocuries per gram)

Number/ Location	Depth (Inches)	Uranium 238	Radium 226	Thorium 232
ST-1/ N9037, E8923	0-6[a]	PNP	0.6	2.2
	6-12[a]	PNP	0.4	PNP
	12-18[a]	2.4	0.4	0.2
	18-24[a]	PNP	0.4	0.6

[a]Preliminary count of wet sample

PNP Peak Not Present

4.4 RESULTS FOR 10 GROVE AVENUE

Surveys and analyses as described in Section 2.0 were conducted on the property located at 10 Grove Avenue.

During the walk-over survey several small, isolated areas of elevated surface readings were detected, as shown in Figure 4-4A. Two of these spots are located at the back of the house, one is between the sidewalk and the street, and the other is on the back property line.

Five surface soil samples and one subsurface Shelby tube sample were collected from six locations on the property, as shown in Figure 4-4B. Results of the laboratory analyses of the samples are presented in Tables 4-4A and 4-4B.

Field observation suggested that runoff from the Ballod property and perhaps the use of soil from the Ballod property as fill material were the likely sources of the contamination. In areas where runoff from the Ballod property is the apparent source, the contamination is confined to the upper few inches of soil; in the other areas it extends to greater depths.

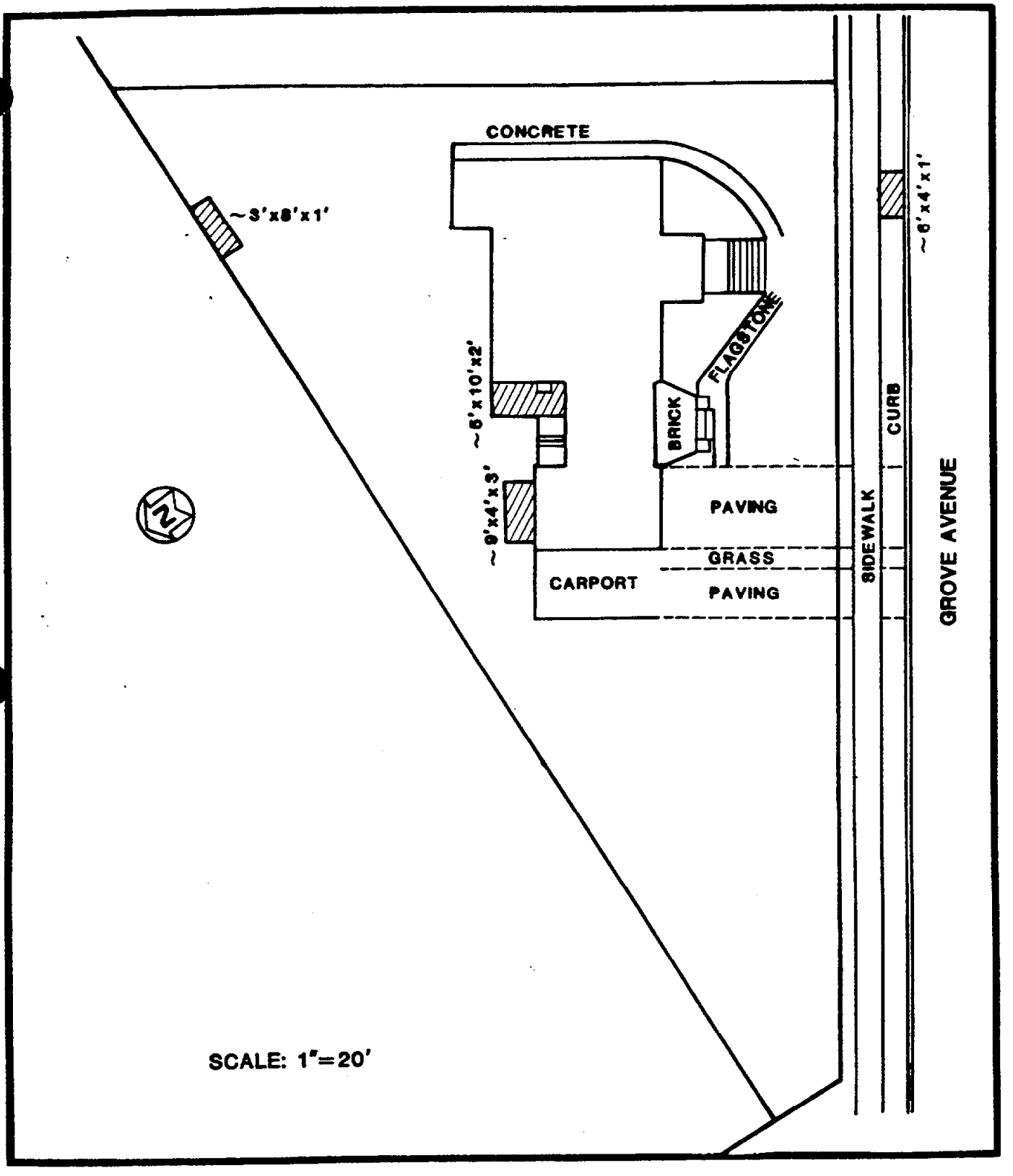

FIGURE 4-4A AREAS OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 10 GROVE AVENUE

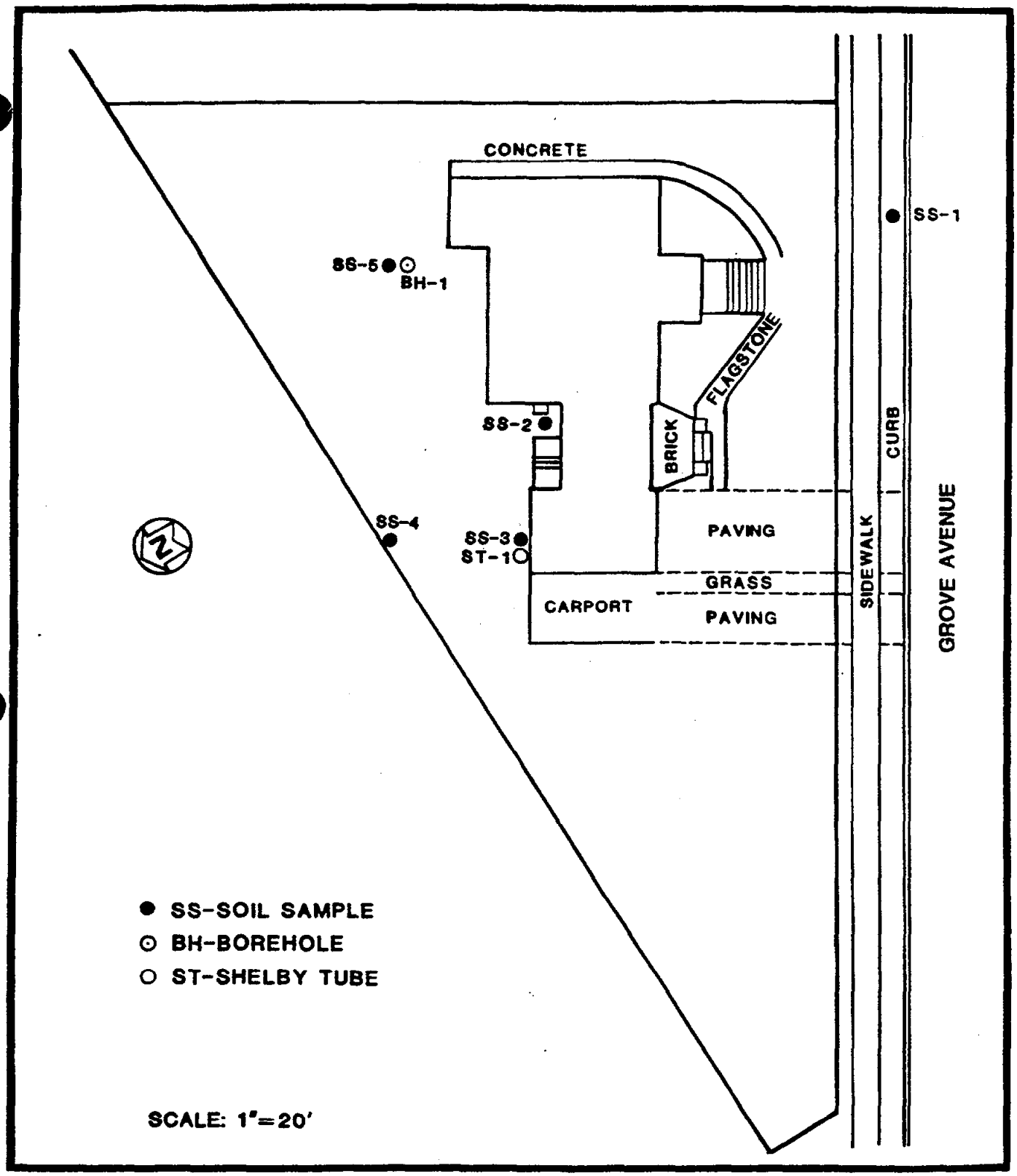

FIGURE 4-4B LOCATIONS OF SURFACE SOIL SAMPLES, BOREHOLE, AND SHELBY TUBE CORE SAMPLE AT 10 GROVE AVENUE

TABLE 4-4A

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 10 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Percent of Criterion[c,d]	Radium 226	Percent of Criterion[d]	Thorium 232	Percent of Criterion[d]	Total Percent of Criteria
SS-1[b]	N8870, E8950	36.2	47	7.3	126	27.1	174	347
SS-2[a]	N8928, E8930	PNP	0	0.9	0	1.1	0	0
SS-3[b]	N8935, E8918	383.0	510	33.0	640	181.0	1200	2350
SS-4[b]	N8950, E8915	PNP	0	1.1	2	6.2	35	37
SS-5[a]	N8950, E8950	PNP	0	1.8	16	PNP	0	16

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled, and recounted
[c]The more restrictive value for natural uranium will be used
[d]Soil criteria [(pCi/g) above background (Ref. 3)]

Radium-226	Surface (0-6 in.)	5
Radium-226	Subsurface	15
Natural Uranium		75
Thorium-232		15

A background concentration of 1 pCi/g was subtracted from the concentrations listed in the table (Ref. 4).

PNP Peak Not Present

TABLE 4-4B

RADIONUCLIDE CONCENTRATIONS IN SUBSURFACE SOIL, 10 GROVE AVENUE

(picocuries per gram)

Number/ Location	Depth (Inches)	Uranium 238	Percent of Criterion[c,d]	Radium 226	Percent of Criterion[d]	Thorium 232	Percent of Criterion[d]	Total Percent of Criteria
ST-1/ N8936, E8913	0-6[b]	5.4	6	10.2	184	38.1	247	437
	6-12[b]	1.5	1	1.6	4	10.1	61	66
	12-18[a]	PNP	0	0.8	0	0.4	0	0
	18-25[b]	4.0	4	5.0	27	19.4	123	154

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled and recounted
[c]The more restrictive value for natural uranium will be used
[d]Soil criteria [(pCi/g) above background (Ref. 3)]

Radium-226	Surface (0-6 in.)	5
Radium-226	Subsurface	15
Natural Uranium		75
Thorium-232		15

A background concentration of 1 pCi/g was subtracted from the concentrations listed in the table (Ref. 4).

PNP Peak Not Present

4.5 RESULTS FOR 14 GROVE AVENUE

Surveys and analyses as described in Section 2.0 were conducted on the property located at 14 Grove Avenue.

During the walk-over survey, slightly elevated readings were observed at the property line with the Ballod land. These were not unexpected in view of the contamination known to exist on the Ballod property. However, no elevated readings were detected within the boundaries of the residential property.

Three surface soil samples were collected in the rear of the property, as shown in Figure 4-5. Results of the laboratory analyses of the samples are presented in Table 4-5. None of the radionuclide concentrations exceed background.

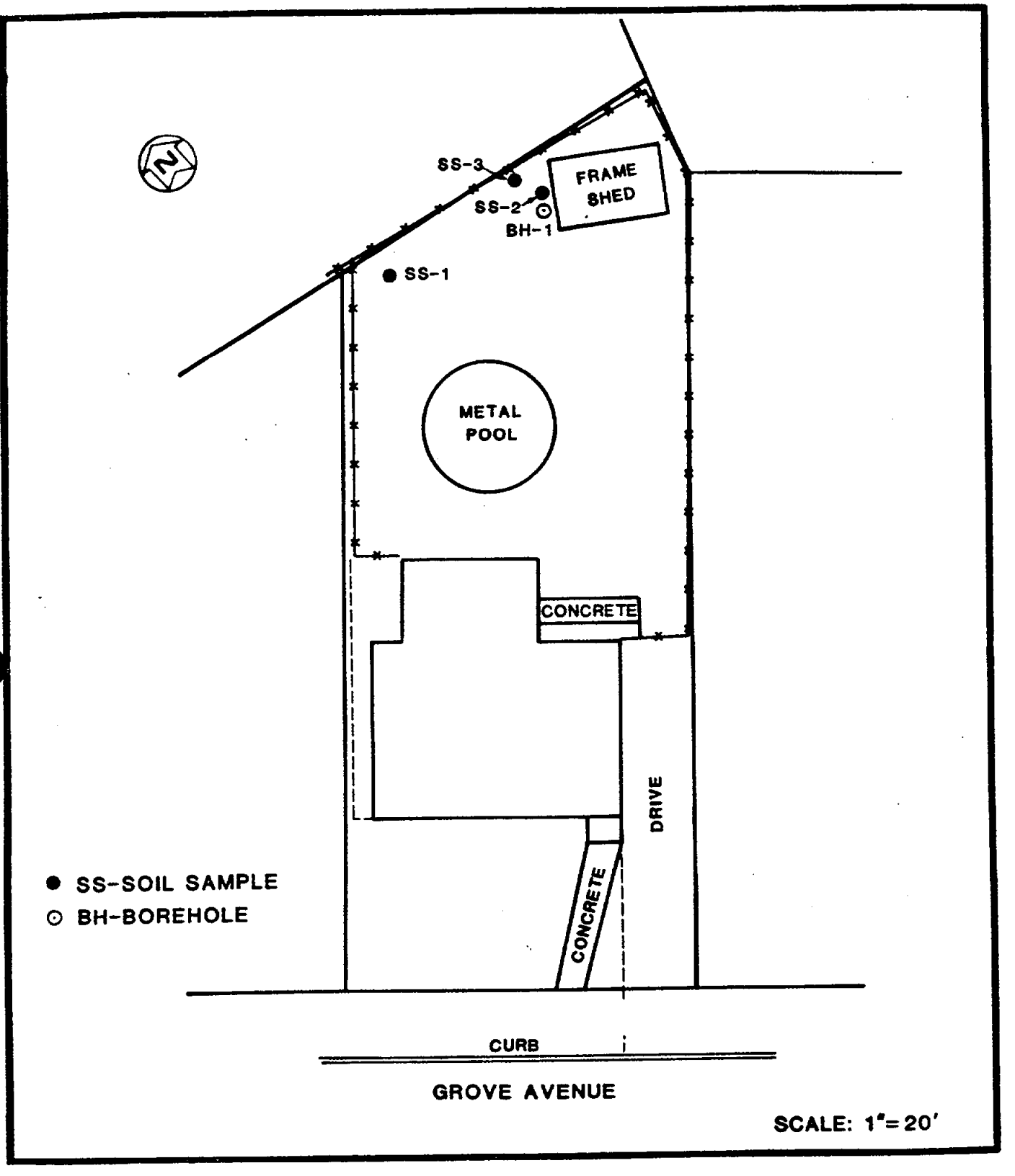

FIGURE 4-5 LOCATIONS OF SURFACE SOIL SAMPLES AND BOREHOLE AT 14 GROVE AVENUE

TABLE 4-5

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 14 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8993, E8976	PNP	PNP	PNP
SS-2[a]	N9000, E9000	PNP	0.5	PNP
SS-3[a]	N9005, E8986	PNP	1.2	PNP

[a]Preliminary count of wet sample

PNP Peak Not Present

4.6 RESULTS FOR 18 GROVE AVENUE

Surveys and analyses as described in Section 2.0 were conducted on the property located at 18 Grove Avenue.

No elevated readings were detected during the walk-over survey.

The gamma exposure rate measurement obtained on the property was 12.3 μR/h. The limit for continuous of the general public established by the Nuclear Regulatory Commission in 10 CFR 20.105 is 500 mrem/yr (Ref. 5). If exposure is assumed to be continuous, this value corresponds to 60 μR/h.

Two surface soil samples were collected from the property, as shown in Figure 4-6. Results of the laboratory analyses of the samples are presented in Table 4-6.

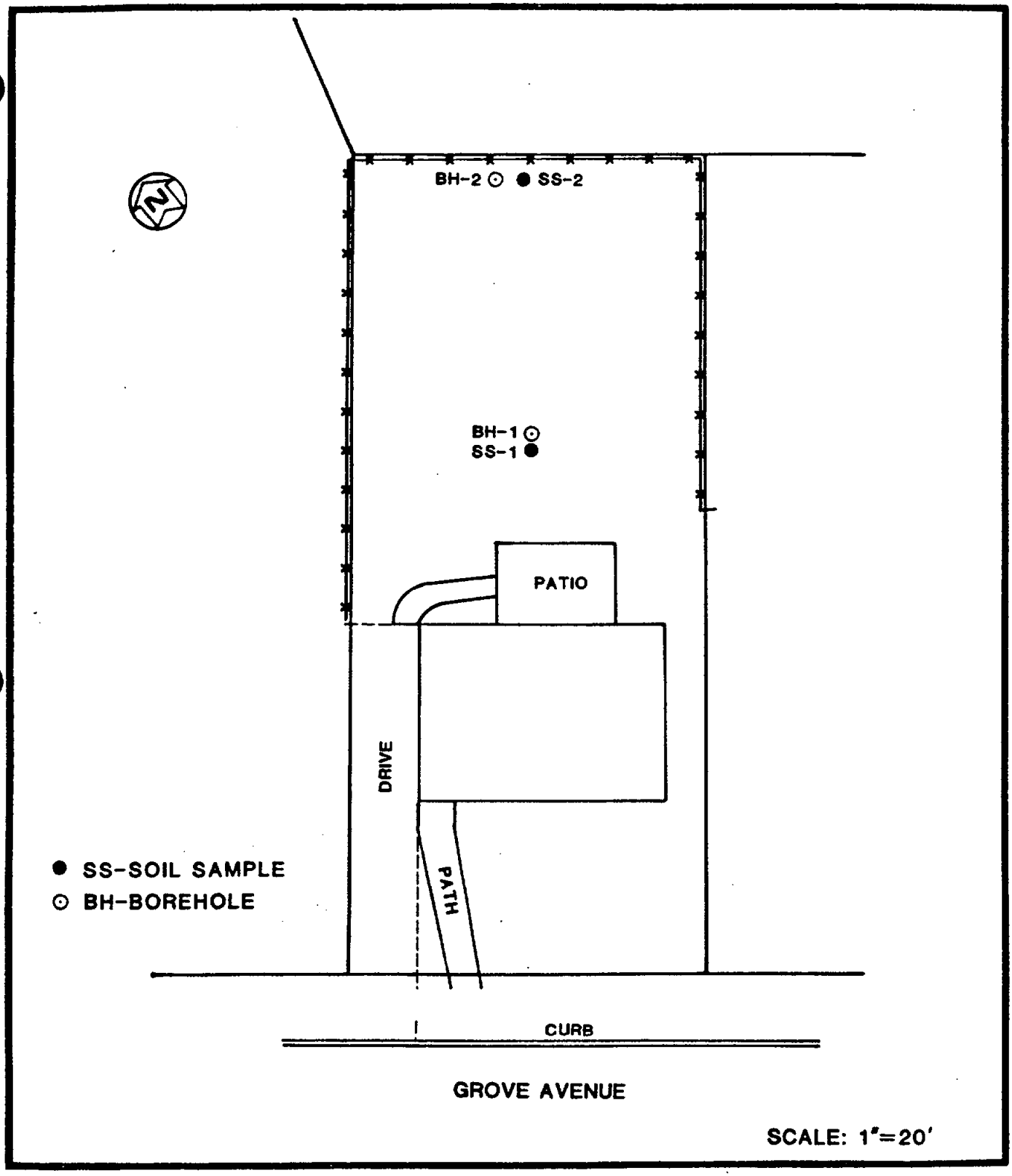

FIGURE 4-6 LOCATIONS OF SURFACE SOIL SAMPLES AND BOREHOLES AT 18 GROVE AVENUE

TABLE 4-6

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 18 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8950, E9050	PNP	1.0	PNP
SS-2[a]	N9000, E9050	PNP	1.0	3.8

[a]Preliminary count of wet sample

PNP Peak Not Present

4.7 RESULTS FOR 22 GROVE AVENUE

Surveys and soil analyses as described in Section 2.0 were conducted on the property located at 22 Grove Avenue.

During the walk-over survey moderately elevated readings were detected in an area of approximately 200 ft^2 in the northeastern corner of the property, as shown in Figure 4-7A.

Five surface soil samples and one subsurface Shelby tube sample were collected from six locations on the property, as shown in Figure 4-7B. Results of the laboratory analyses of the samples are presented in Tables 4-7A and 4-7B.

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.

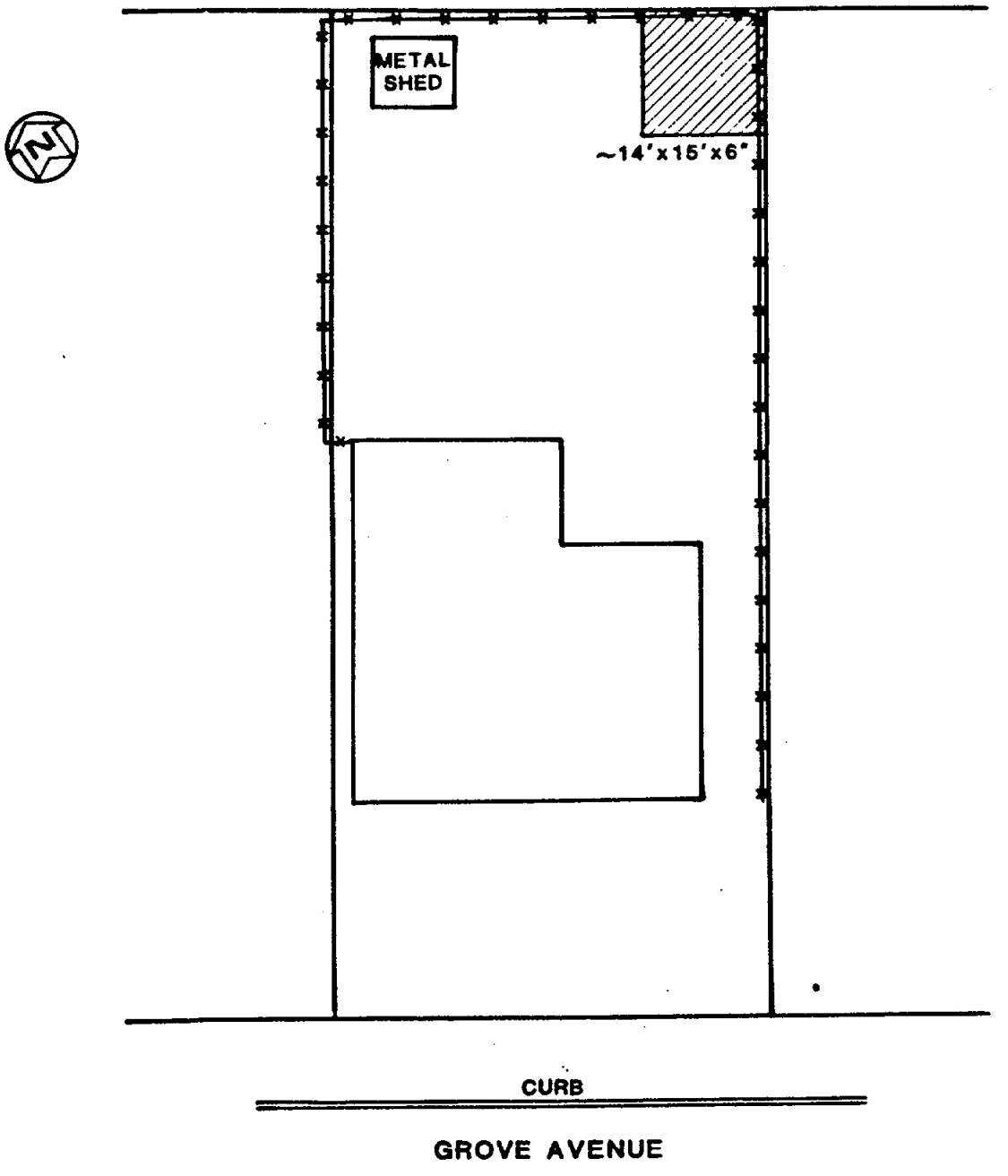

FIGURE 4-7A AREA OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 22 GROVE AVENUE

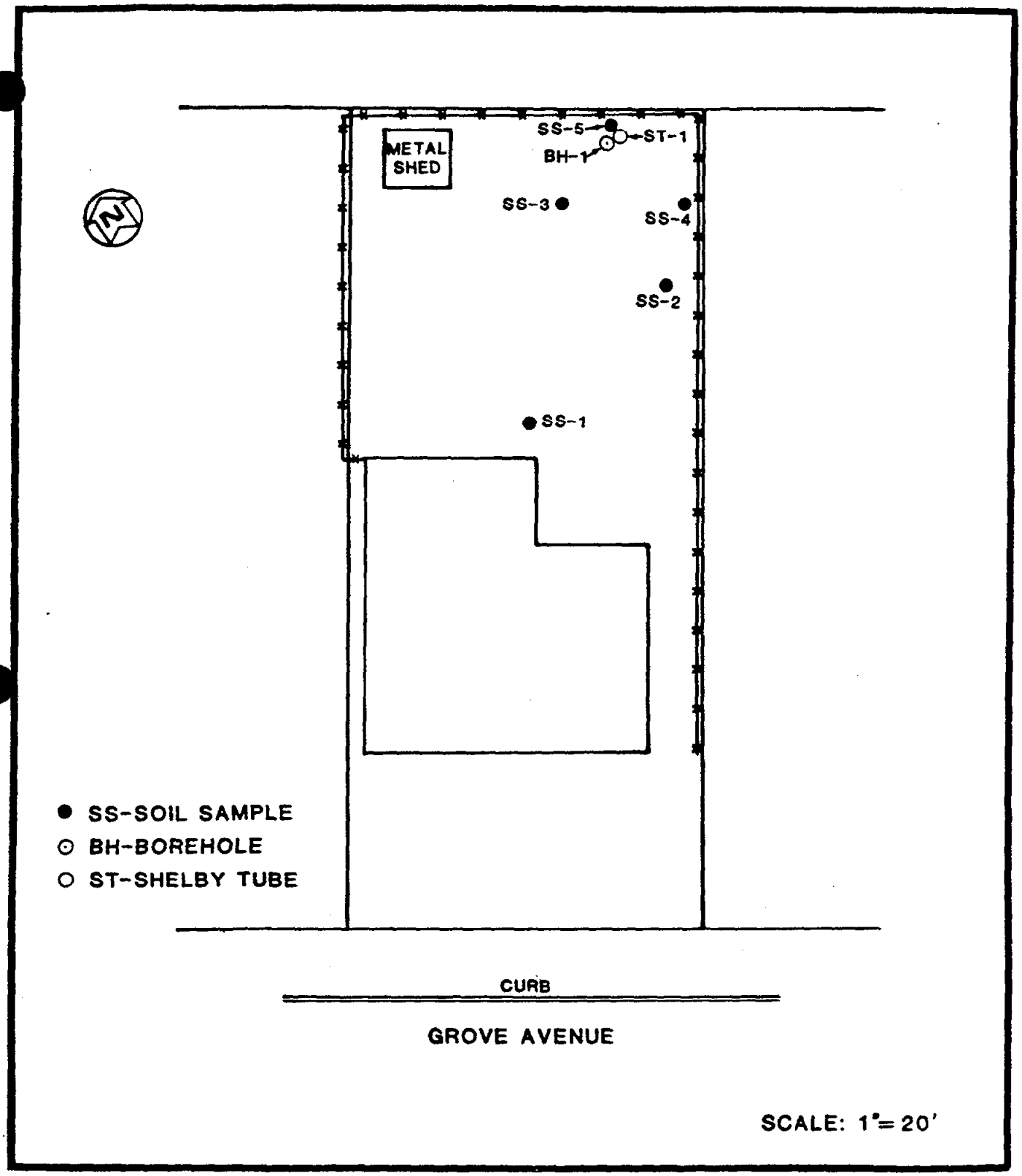

FIGURE 4-7B LOCATIONS OF SURFACE SOIL SAMPLES, BOREHOLE, AND SHELBY TUBE CORE SAMPLE AT 22 GROVE AVENUE

TABLE 4-7A

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 22 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Percent of Criterion[c,d]	Radium 226	Percent of Criterion[d]	Thorium 232	Percent of Criterion[d]	Total Percent of Criteria
SS-1[a]	N8960, E9100	PNP	0	0.8	0	PNP	0	0
SS-2[a]	N8980, E9120	PNP	0	PNP	0	PNP	0	0
SS-3[a]	N8992, E9107	PNP	0	PNP	0	2.5	10	10
SS-4[b]	N8992, E9124	29.9	39	3.3	46	16.1	101	186
SS-5[a]	N8997, E9115	22.7	29	2.2	24	13.8	85	138

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled, and recounted
[c]The more restrictive value for natural uranium will be used
[d]Soil criteria [(pCi/g) above background (Ref. 3)]

Radium-226	Surface (0-6 in.)	5
Radium-226	Subsurface	15
Natural Uranium		75
Thorium-23		15

A background concentration of 1 pCi/g was subtracted from the concentrations listed in the table (Ref. 4).

PNP Peak Not Present

TABLE 4-7B

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]Preliminary count of wet sample

PNP Peak Not Present

4.8 RESULTS FOR 26 GROVE AVENUE

Surveys and soil analyses as described in Section 2.0 were conducted on the property located at 26 Grove Avenue.

During the walk-over survey elevated readings were detected in an area of approximately 225 ft^2 in the northeastern corner of the property, as shown in Figure 4-8A.

The gamma exposure rate measurement obtained on the property was 18.4 μR/h. The limit for exposure of the general public established by the Nuclear Regulatory Commission in 10 CFR 20.105 is 500 mrem/yr (Ref. 5). If exposure is assumed to be continuous, this value corresponds to 60 μR/h.

Five surface soil samples and one subsurface Shelby tube sample were collected from six locations on the property, as shown in Figure 4-8B. Results of the laboratory analyses of the samples are presented in Tables 4-8A and 4-8B.

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. Radionuclide concentrations on the surface may be significantly higher than those found in the first few inches of soil.

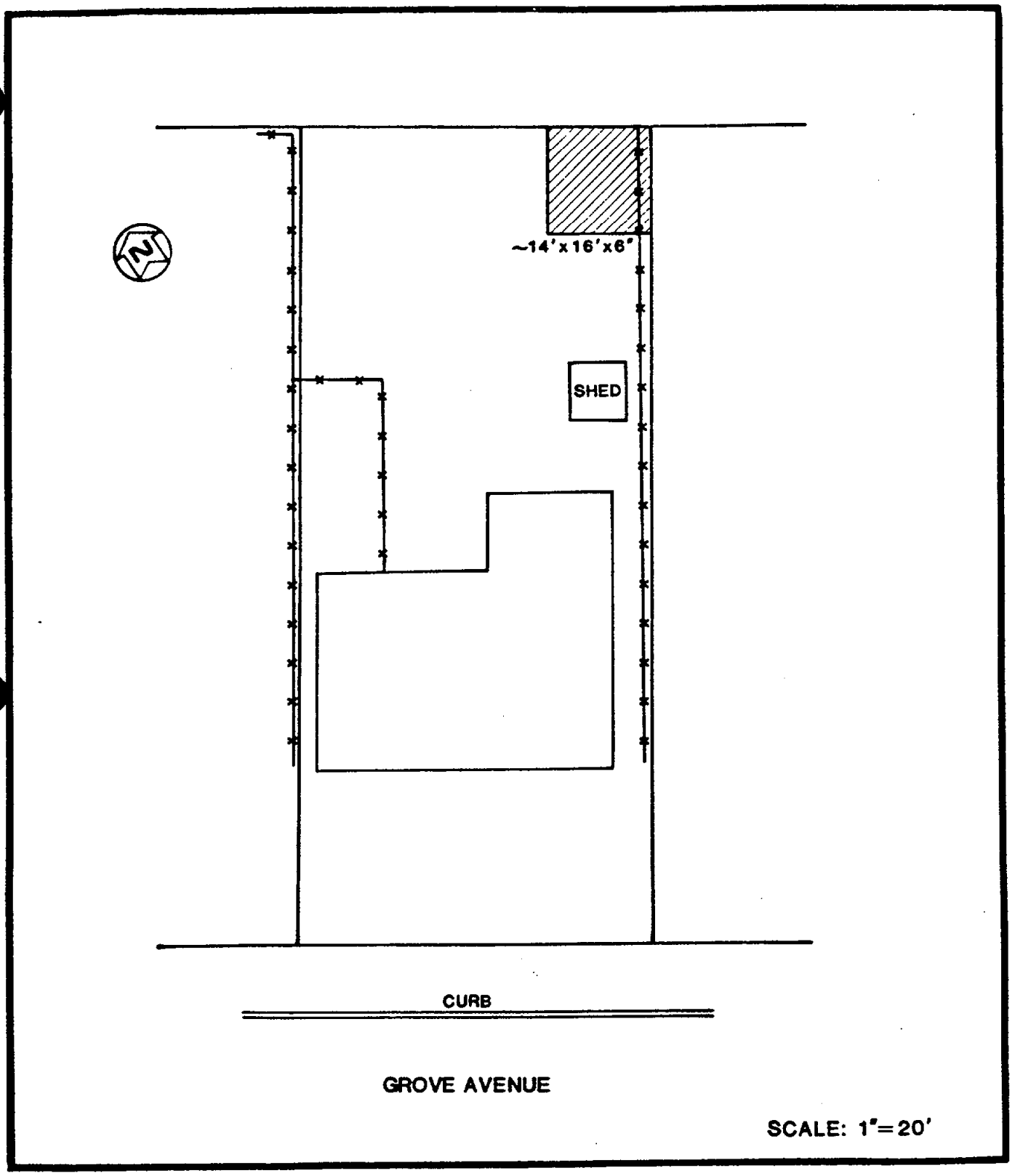

FIGURE 4-8A AREA OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 26 GROVE AVENUE

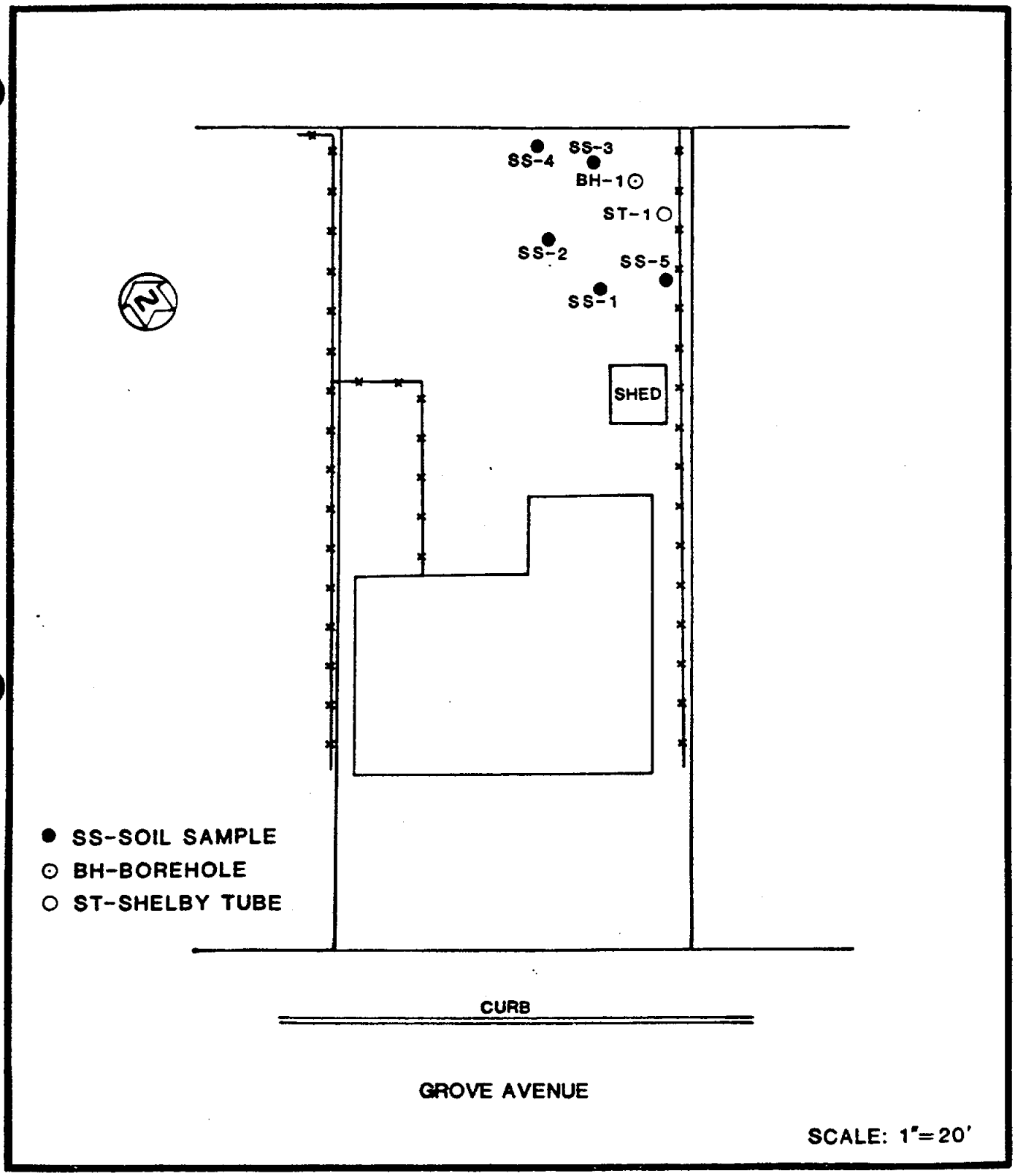

FIGURE 4-8B LOCATIONS OF SURFACE SOIL SAMPLES, BOREHOLE, AND SHELBY TUBE CORE SAMPLE AT 26 GROVE AVENUE

TABLE 4-8A

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 26 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8980, E9163	PNP	1.0	2.2
SS-2[a]	N8986, E9153	PNP	1.6	1.2
SS-3[a]	N8994, E9164	PNP	2.0	1.6
SS-4[a]	N8999, E9150	14.2	1.2	1.2
SS-5[a]	N8981, E9170	PNP	0.7	0.9

[a]Preliminary count of wet sample

PNP Peak Not Present

TABLE 4-8B

RADIONUCLIDE CONCENTRATIONS IN SUBSURFACE SOIL, 26 GROVE AVENUE

(picocuries per gram)

Number/ Location	Depth (Inches)	Uranium 238	Radium 226	Thorium 232
ST-1/ N8986, E9169	0-6[a]	4.2	0.7	4.3
	6-12[a]	PNP	1.0	0.8
	12-18[a]	PNP	1.0	1.3
	18-22[a]	PNP	0.7	1.4

[a]Preliminary count of wet sample

PNP Peak Not Present

4.9 RESULTS FOR 30 GROVE AVENUE

Surveys and soil analyses as described in Section 2.0 were conducted on the property located at 30 Grove Avenue.

During the walk-over survey elevated readings were detected in an area in the rear of the property, as shown in Figure 4-9A.

Four surface soil samples were collected, as shown in Figure 4-9B. Three of these were in the area of elevated walk-over scan readings. Results of the laboratory analyses of the samples are presented in Table 4-9.

Contamination appears to be 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. Radionuclide concentrations on the surface may be significantly higher than those found in the first few inches of soil.

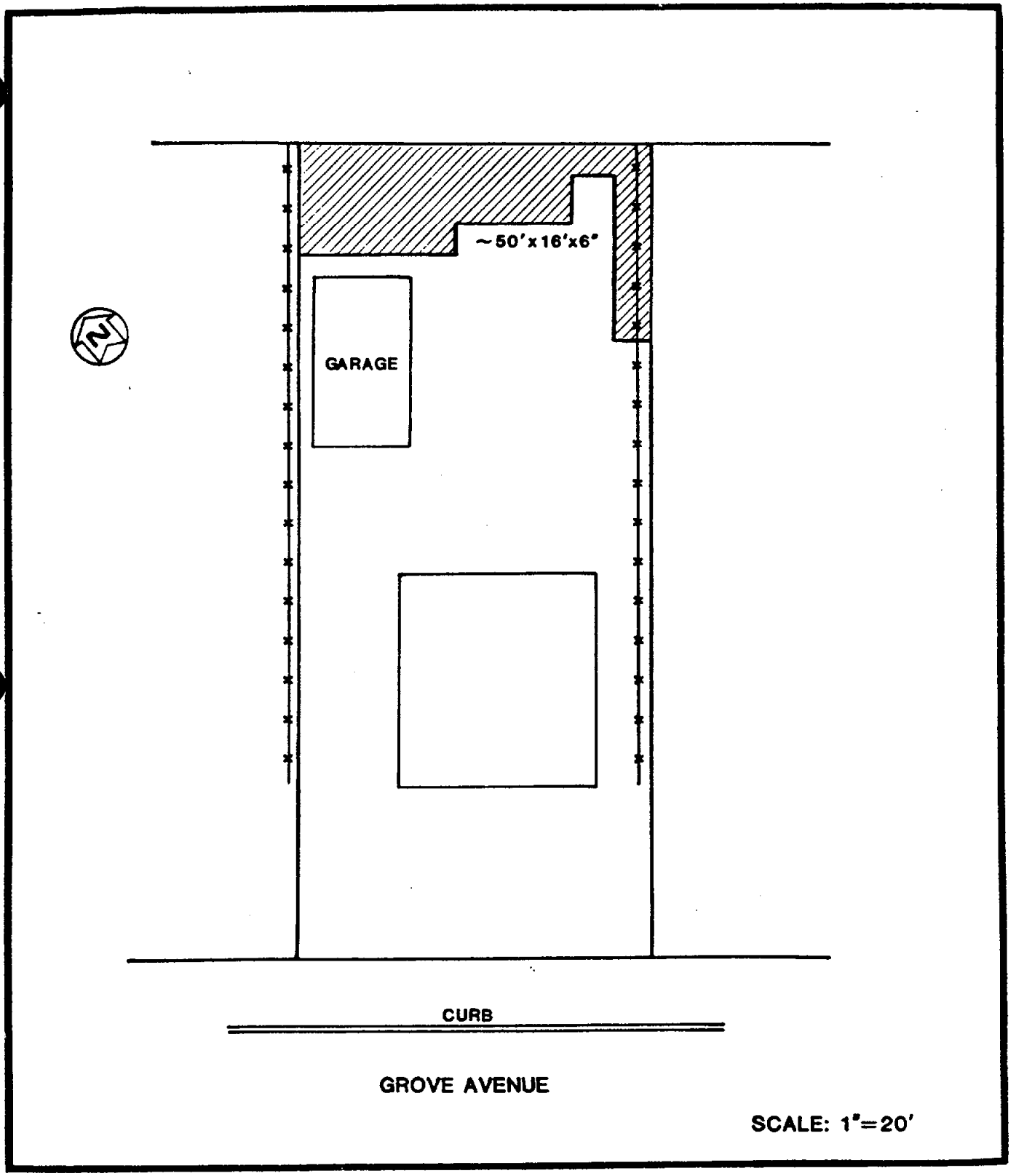

FIGURE 4-9A AREA OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 30 GROVE AVENUE

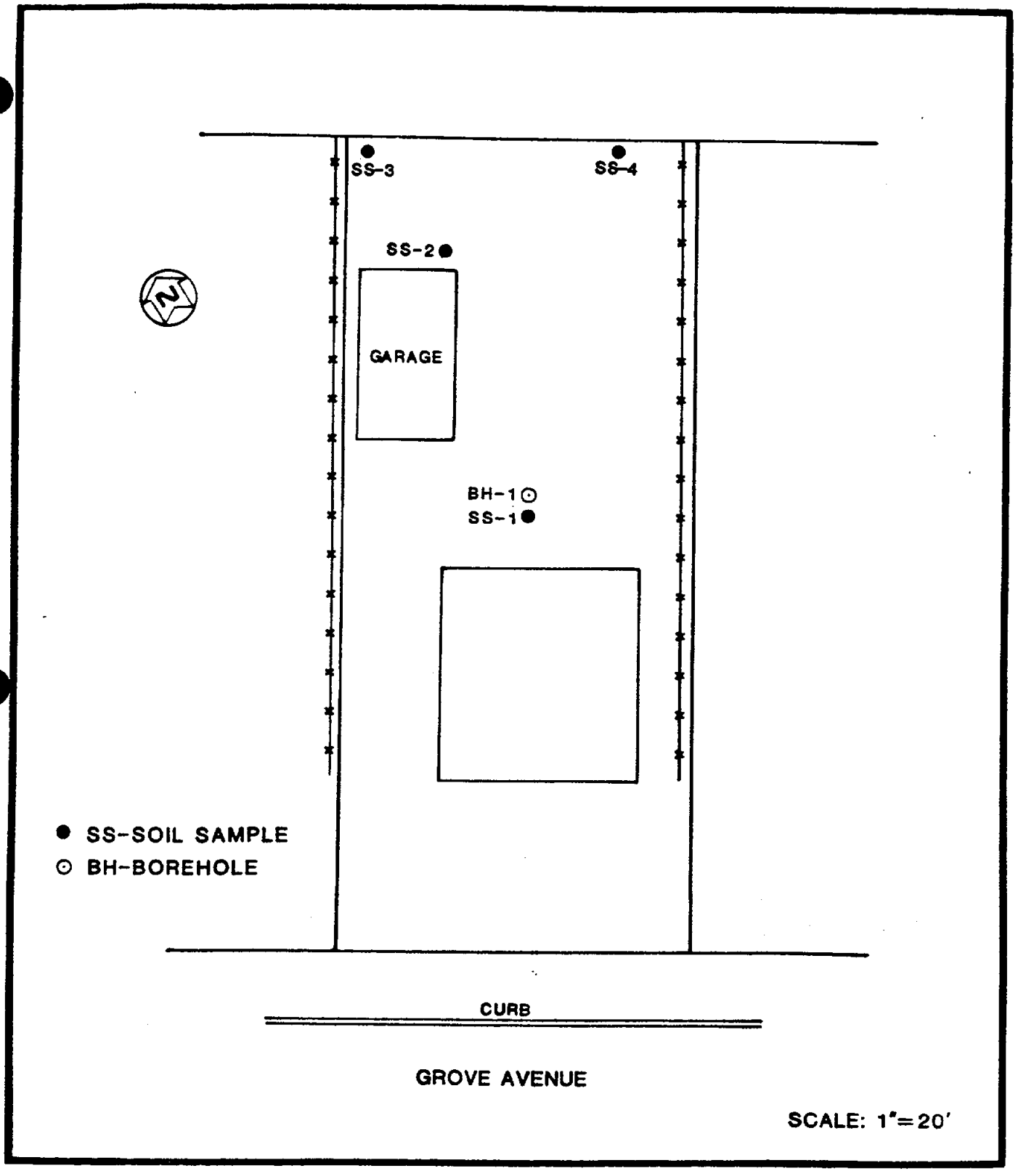

FIGURE 4-9B LOCATIONS OF SURFACE SOIL SAMPLES AND BOREHOLE AT 30 GROVE AVENUE

TABLE 4-9

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 30 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8950, E9200	PNP	1.2	PNP
SS-2[b]	N8982, E9184	PNP	1.2	4.0
SS-3[b]	N9000, E9175	3.5	2.5	8.4
SS-4[a]	N9000, E9213	PNP	1.2	PNP

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled, and recounted

PNP Peak Not Present

4.10 RESULTS FOR 34 GROVE AVENUE

Surveys and soil analyses as described in Section 2.0 were conducted on the property located at 34 Grove Avenue.

Two areas of elevated readings were detected during the walk-over survey, as shown in Figure 4-10A.

The gamma exposure rate measurement obtained on the property in close proximity to the Ballod property was 16.2 μR/h. The limit for exposure of the general public established by the Nuclear Regulatory Commission in 10 CFR 20.105 is 500 mrem/yr (Ref. 5). If exposure is assumed to be continuous, this value corresponds to 60 μR/h.

Six surface soil samples were collected in areas of elevated walk-over scan readings, as shown in Figure 4-10B. Results of the laboratory analyses of the samples are presented in Table 4-10.

Contamination appears to be 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.

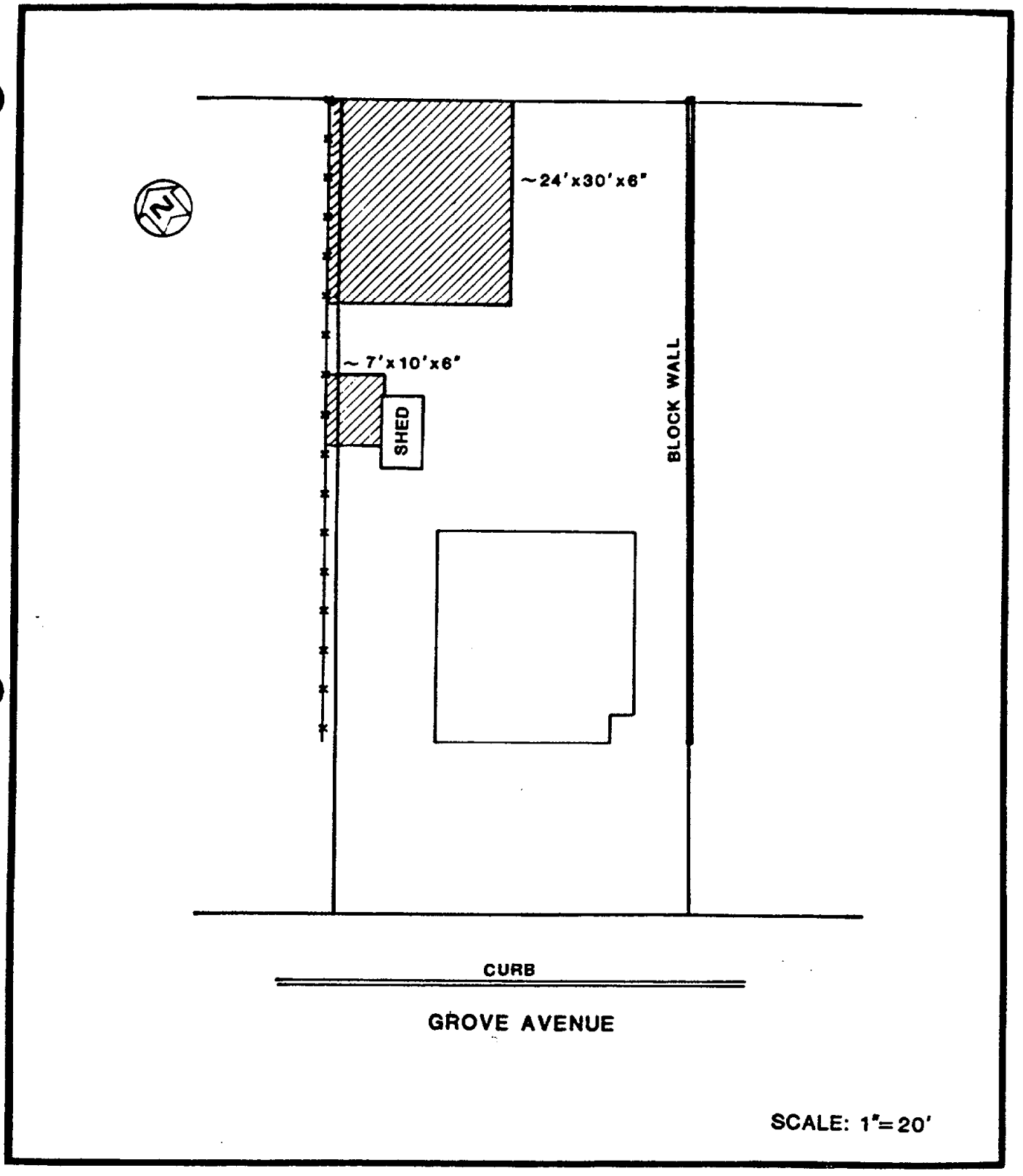

FIGURE 4-10A AREAS OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 34 GROVE AVENUE

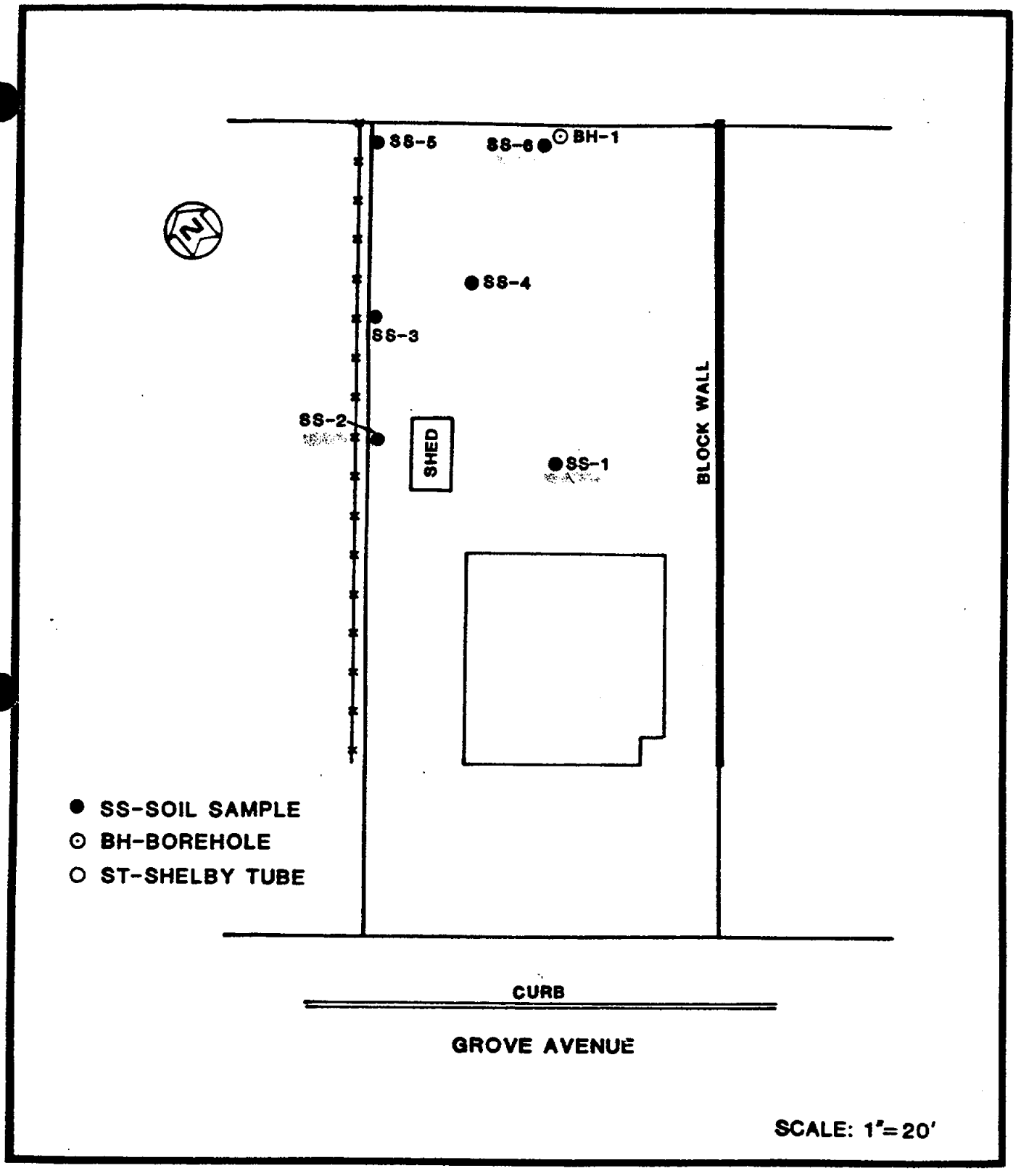

FIGURE 4-10B LOCATIONS OF SURFACE SOIL SAMPLES AND BOREHOLE AT 34 GROVE AVENUE

TABLE 4-10

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 34 GROVE AVENUE

(picocuries per gram)

Number	Location/Depth (in.)	Uranium 238	Percent of Criterion[c,d]	Radium 226	Percent of Criterion[d]	Thorium 232	Percent of Criterion[d]	Total Percent of Criteria
SS-1[a]	N8952, E9250	PNP	0	1.2	4	3.4	16	20
SS-2[b]	N8953, E9225	2.4	2	2.7	34	19.0	120	156
SS-3[b]	N8967, #9225	1.0	0	0.9	0	3.2	15	15
SS-4[a]	N8973, E9241	PNP	0	0.8	0	2.9	13	13
SS-5[b]	N8994, E9225	1.7	1	0.9	0	6.1	34	35
SS-6[a]	N8996, E9250	PNP	0	0.6	0	3.8	19	19

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled, and recounted
[c]The more restrictive value for natural uranium will be used
[d]Soil criteria [(pCi/g) above background (Ref.3)]

Radium-226	Surface (0-6 in.)	5
Radium-226	Subsurface	15
Uranium-Natural		75
Thorium-232		15

A background concentration of 1 pCi/g was subtracted from the concentrations listed in the table (Ref.4).

PNP Peak Not Present

4.11 RESULTS FOR 38 GROVE AVENUE

Surveys and soil analyses as described in Section 2.0 were conducted on the property located at 38 Grove Avenue.

No elevated readings were detected during the walk-over survey.

Two surface soil samples were collected, one in the middle and one at the rear of the property, as shown in Figure 4-11. Results of the laboratory analyses of the samples are presented in Table 4-11.

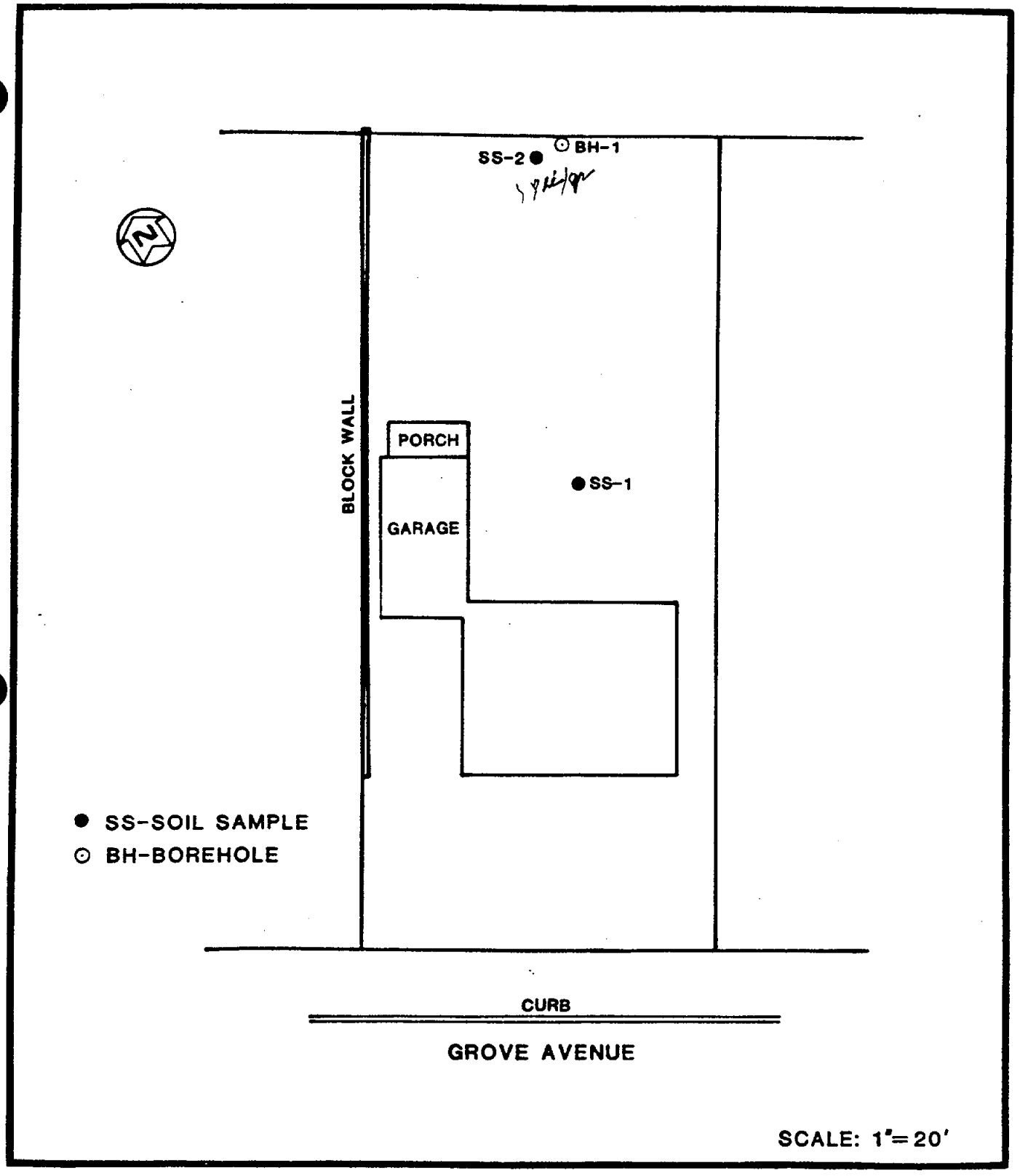

FIGURE 4-11 LOCATIONS OF SURFACE SOIL SAMPLES AND BOREHOLE AT 38 GROVE AVENUE

TABLE 4-11

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 38 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8950, E9300	PNP	PNP	PNP
SS-2[a]	N8995, E9293	PNP	1.0	PNP

[a]Preliminary count of wet sample

PNP Peak Not Present

4.12 RESULTS FOR 42 GROVE AVENUE

Surveys and soil analyses as described in Section 2.0 were conducted on the property located at 42 Grove Avenue.

During the walk-over survey elevated readings were detected in an area at the rear of the property, as shown in Figure 4-12A.

The gamma exposure rate measurement obtained on the property in close proximity to the Ballod property was 16.3 μR/h. The limit for exposure of the general public established by the Nuclear Regulatory Commission in 10 CFR 20.105 is 500 mrem/yr (Ref. 5). If exposure is assumed to be continuous, this value corresponds to 60 μR/h.

Seven surface soil samples and one subsurface Shelby tube sample were collected from eight locations on the property, as shown in Figure 4-12B. Results of the laboratory analyses of the samples are presented in Tables 4-12A and 4-12B.

Surface and subsurface sampling indicated that contamination is confined to the upper 18 inches of soil. Field observation suggested that runoff from the Ballod property was probably the source of the contamination.

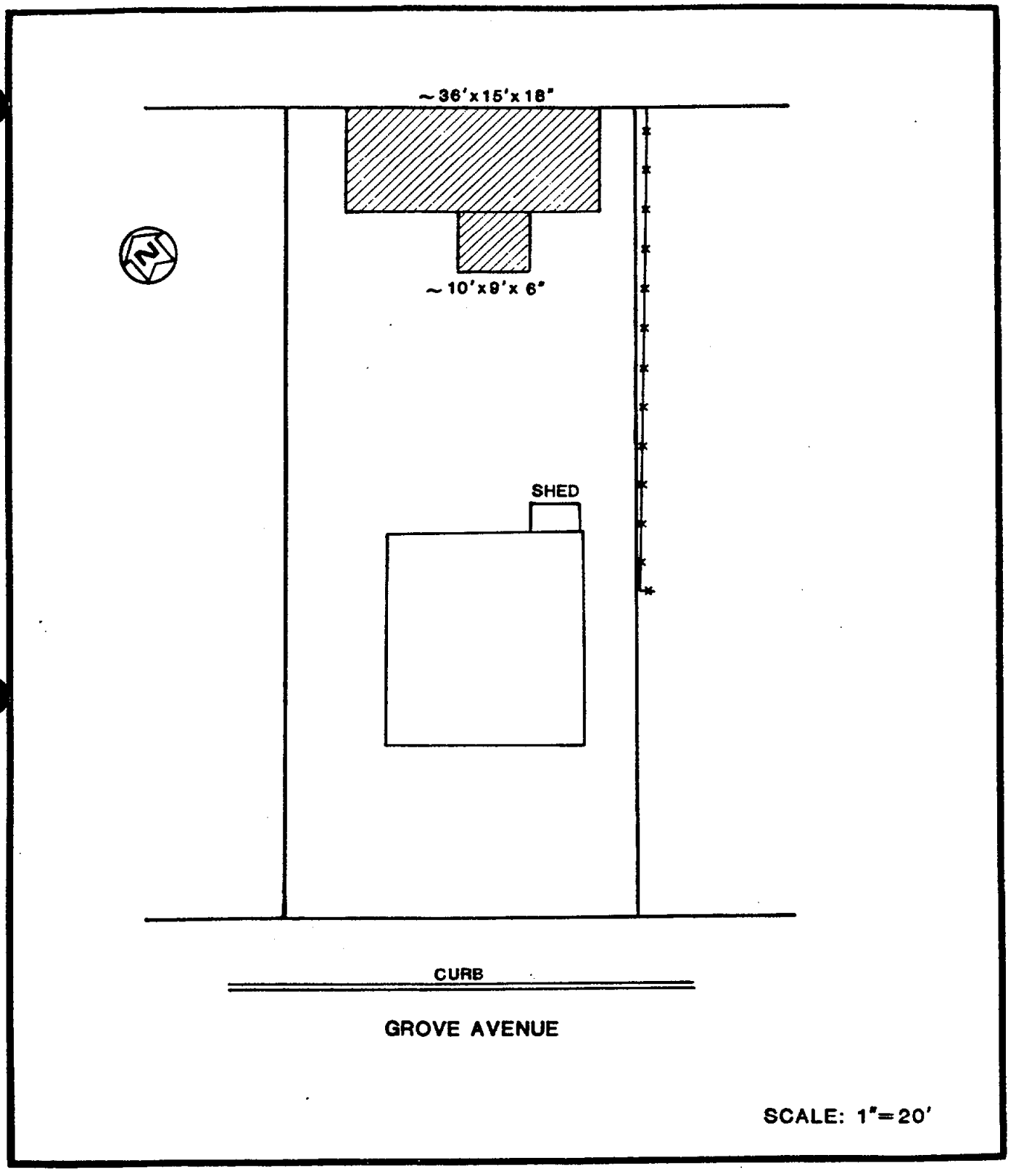

FIGURE 4-12A AREA OF ELEVATED RADIONUCLIDE CONCENTRATIONS AT 42 GROVE AVENUE

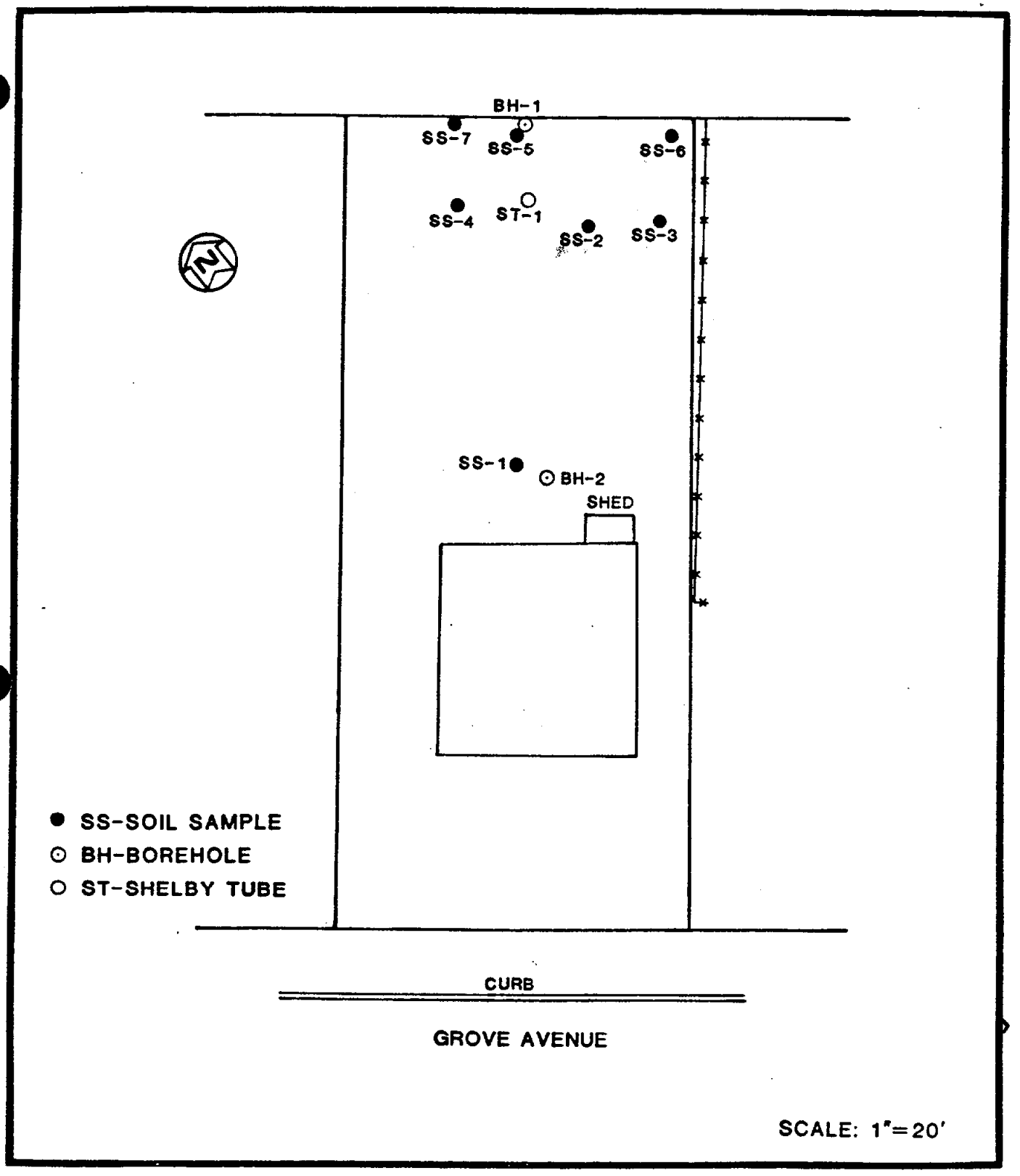

FIGURE 4-12B LOCATIONS OF SURFACE SOIL SAMPLES, BOREHOLES, AND SHELBY TUBE CORE SAMPLE AT 42 GROVE AVENUE

TABLE 4-12A

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 42 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Percent of Criterion[c,d]	Radium 226	Percent of Criterion[d]	Thorium 232	Percent of Criterion[d]	Total Percent of Criteria
SS-1[a]	N8950, E9350	PNP	0	1.4	8	PNP	0	8
SS-2[b]	N8984, E9359	21.4	27	2.6	32	4.5	23	82
SS-3[a]	N8984, E9369	PNP	0	1.6	12	4.8	25	37
SS-4[a]	N8987, E9343	PNP	0	1.4	8	2.4	9	17
SS-5[b]	N8997, E9350	27.0	35	5.4	88	7.6	44	167
SS-6[b]	N8993, E9370	17.7	22	1.7	14	6.9	39	75
SS-7[a]	N8997, E9341	PNP	0	1.6	12	4.0	20	32

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled, and recounted
[c]The more restrictive value for natural uranium will be used
[d]Soil criteria [(pCi/g) above background (Ref. 3)]

Radium-226	Surface (0-6 in.)	5
Radium-226	Subsurface	15
Uranium-Natural		75
Thorium-232		15

A background concentration of 1 pCi/g was subtracted from the concentrations listed in the table (Ref. 4).

PNP Peak Not Present

TABLE 4-12B

RADIONUCLIDE CONCENTRATIONS IN SUBSURFACE SOIL, 42 GROVE AVENUE

(picocuries per gram)

Number/ Location	Depth (Inches)	Uranium 238	Percent of Criterion[c,d]	Radium 226	Percent of Criterion[d]	Thorium 232	Percent of Criterion[d]	Total Percent of Criteria
ST-1/ N8986, E9350	0-6[b]	8.5	10	1.8	16	12.1	74	100
	6-12[b]	59.3	78	3.3	15	15.2	95	188
	12-18[b]	1.9	1	8.4	49	12.9	80	130
	18-24[a]	6.8	8	1.0	0	2.2	8	16
	24-30[a]	PNP	0	0.6	0	2.2	8	8
	30-36[a]	PNP	0	0.4	0	0.8	0	0
	36-40[a]	PNP	0	0.4	0	PNP	0	0
	40-48[a]	1.0	0	0.4	0	0.2	0	0

[a]Preliminary count of wet sample
[b]Sample dried, ball-milled, and recounted
[c]The more restrictive value for natural uranium will be used
[d]Soil criteria [(pCi/g) above background (Ref. 3)]

Radium-226	Surface (0-6 in.)	5
Radium-226	Subsurface	15
Uranium-Natural		75
Thorium-232		15

A background concentration of 1 pCi/g was subtracted from the concentrations listed in the table (Ref. 4).

PNP Peak Not Present

4.13 RESULTS FOR 46 GROVE AVENUE

Surveys and analyses as described in Section 2.0 were conducted on the property located at 46 Grove Avenue.

No elevated readings were detected during the walk-over survey.

Two surface soil samples and one subsurface Shelby tube sample were collected from three locations at the rear of the property, as shown in Figure 4-13. Results of the laboratory analyses of the samples are presented in Tables 4-13A and 4-13B.

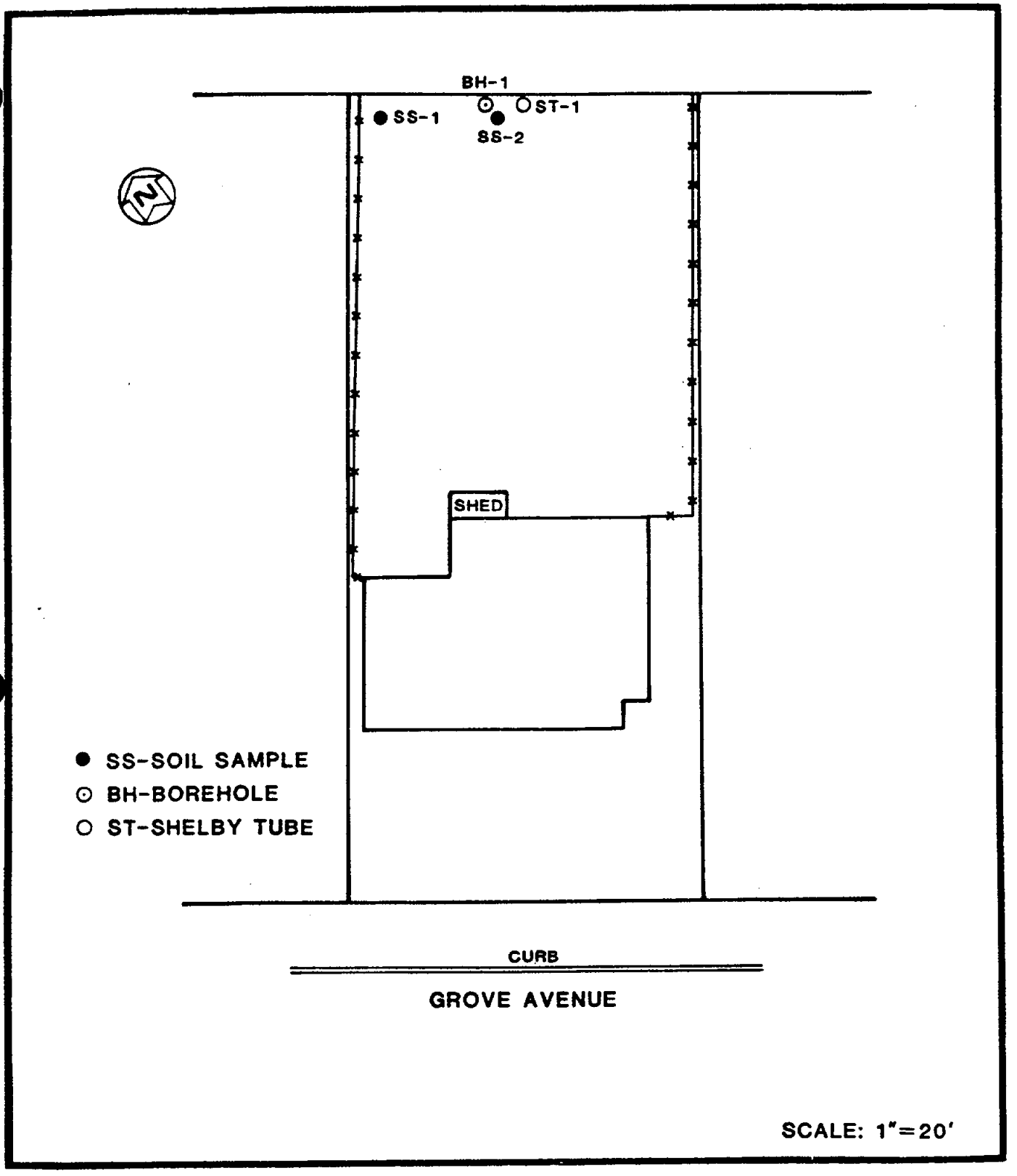

FIGURE 4-13 LOCATIONS OF SURFACE SOIL SAMPLES, BOREHOLE, AND SHELBY TUBE CORE SAMPLE AT 46 GROVE AVENUE

TABLE 4-13A

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 46 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8994, E9378	PNP	0.8	PNP
SS-2[a]	N8996, E9400	PNP	1.6	4.2

[a]Preliminary count of wet sample

PNP Peak Not Present

TABLE 4-13B

RADIONUCLIDE CONCENTRATIONS IN SUBSURFACE SOIL, 46 GROVE AVENUE

(picocuries per gram)

Number/ Location	Depth (Inches)	Uranium 238	Radium 226	Thorium 232
ST-1/ N8996, E9404	0-6[a]	PNP	1.6	5.0
	6-12[a]	PNP	1.2	3.7
	2-18[a]	1.0	1.4	4.4
	8-27[a]	PNP	0.6	1.1

[a]Preliminary count of wet sample

PNP Peak Not Present

4.14 RESULTS FOR 50 GROVE AVENUE

Surveys and analyses as described in Section 2.0 were conducted on the property located at 50 Grove Avenue.

No elevated readings were detected during the walk-over survey.

Since the entire yard was concreted, a surface soil sample was collected on the boundary with the Ballod property, as shown in Figure 4-14. Results of the laboratory analyses of the sample is presented in Table 4-14.

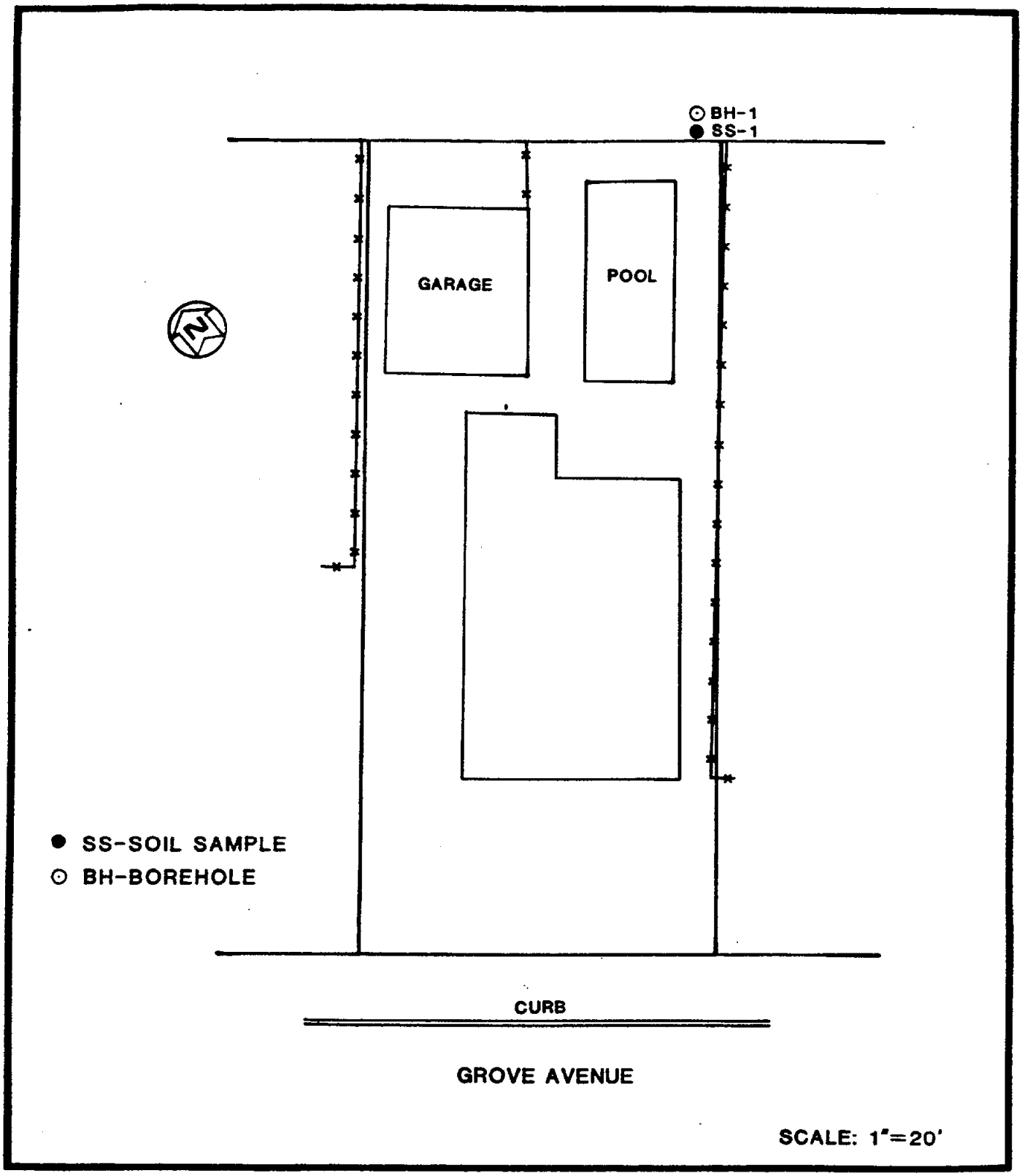

FIGURE 4-14 LOCATIONS OF SURFACE SOIL SAMPLE AND BOREHOLE AT 50 GROVE AVENUE

TABLE 4-14

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 50 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8996, E9474	PNP	1.6	2.1

[a]Preliminary count of wet sample

PNP Peak Not Present

4.15 RESULTS FOR 54 GROVE AVENUE

Surveys and analyses as described in Section 2.0 were conducted on the property located at 54 Grove Avenue.

No elevated readings were detected during the walk-over survey.

The gamma exposure rate measurement obtained on the property in close proximity to the Ballod property was 9.6 μR/h. The limit for exposure of the general public established by the Nuclear Regulatory Commission in 10 CFR 20.105 is 500 mrem/yr (Ref. 5). If exposure is assumed to be continuous, this value corresponds to 60 μR/h.

A surface soil sample was collected from the back property line, as shown in Figure 4-15. The result of the laboratory analysis of the sample is presented in Table 4-15.

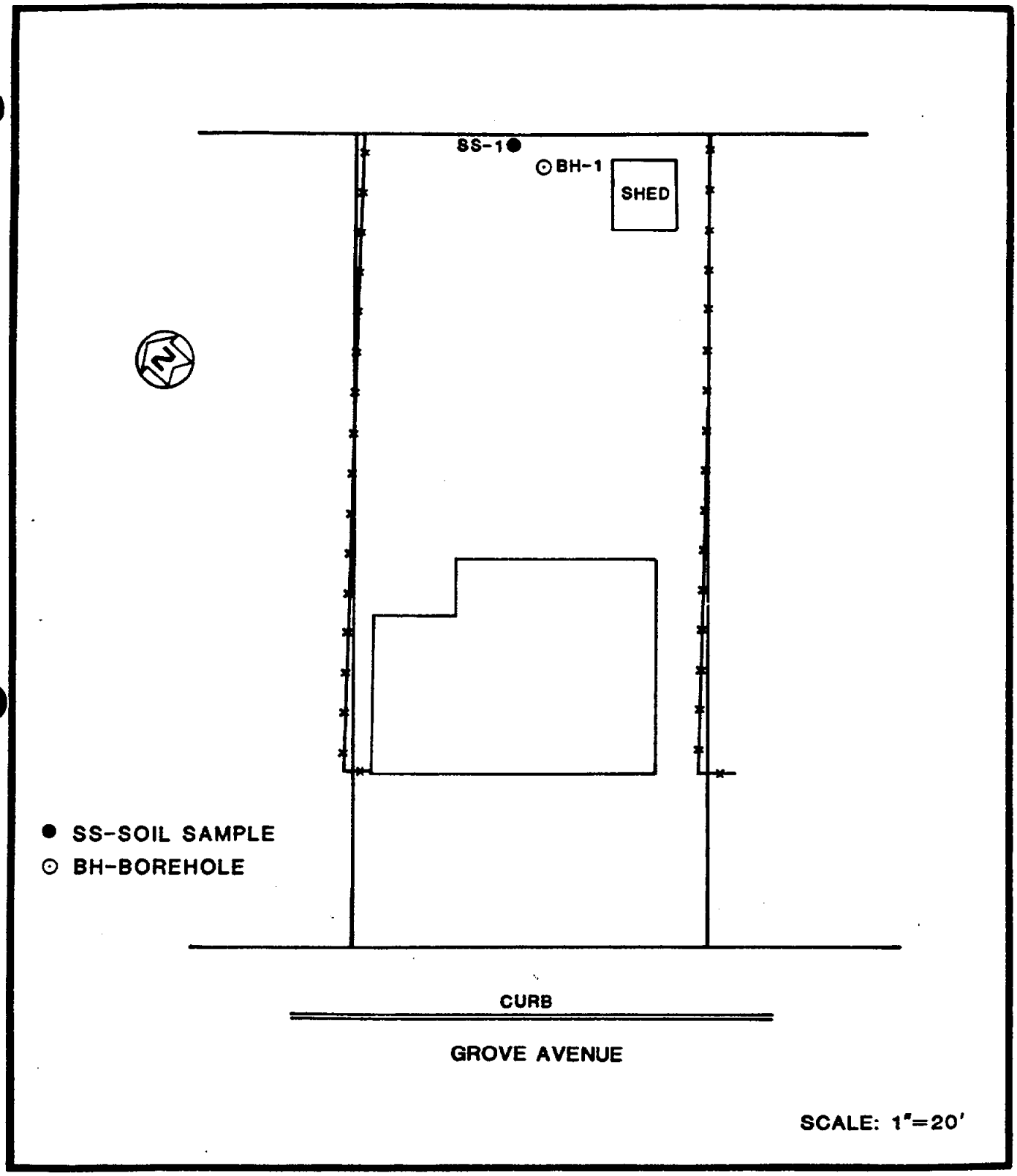

FIGURE 4-15 LOCATIONS OF SURFACE SOIL SAMPLE AND BOREHOLE AT 54 GROVE AVENUE

TABLE 4-15

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL, 54 GROVE AVENUE

(picocuries per gram)

Number	Location	Uranium 238	Radium 226	Thorium 232
SS-1[a]	N8992, E9499	PNP	1.0	PNP

[a]Preliminary count of wet sample

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), March 1984.

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

5. U.S. Code of Federal Regulations. 10 CFR 20.105, "Permissible Levels of Radiation in Unrestricted Areas," Washington, D.C., January 1983.