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Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the Maywood Site, New Jersey

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(MJ01L)

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RESULTS OF THE INDEPENDENT RADIOLOGICAL VERIFICATION SURVEY AT 90 PARK WAY, ROCHELLE PARK, NEW JERSEY (MJ01L)

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RESULTS OF THE INDEPENDENT RADIOLOGICAL VERIFICATION SURVEY AT 90 PARK WAY, ROCHELLE PARK, NEW JERSEY (MJ01L)*

INTRODUCTION

Processing of thorium ores was performed in Maywood, New Jersey, between 1916 and 1956 by the Maywood Chemical Works.[1] During the course of thorium processing, the wastes from the operations were pumped to diked areas west of the plant. Additional material was placed in two piles surrounded by earthen dikes. In 1932, Route 17 was built through this disposal area. The Maywood Chemical Works ceased thorium processing in 1956 and subsequently was sold to Stepan Chemical in 1959. After 1963, on several occasions wastes were removed from the west side of New Jersey Route 17. In 1984, the Department of Energy (DOE) was assigned by Congress the responsibility for the decontamination project involving the site and vicinity properties in Maywood and Rochelle Park under the Formerly Utilized Sites Remedial Action Program (FUSRAP).

This site, referred to as the Maywood site, on which surface and subsurface radionuclide concentrations occurred in excess of the DOE criteria listed in Table 1, is now owned by Ballod and Associates. It has been identified through assessment procedures by Oak Ridge Associated Universities and Nuclear Safety Associates, Inc.,[1,2] for the purpose of decontamination based on DOE's remedial action objectives. The Maywood site and vicinity properties, which include the residential properties on Grove Avenue and Park Way, were assigned by DOE to FUSRAP although the contamination at the Maywood site did not result from the Atomic Energy Program.

From June to December, 1984, Bechtel National, Inc. (BNI), the project management contractor designated by DOE, performed remedial action on this residential property. This remedial action is the first one in the Rochelle Park area that will be followed by ~10 other designated properties (Fig. 1). Based on drawings showing the extent of contamination, the property was excavated and the contaminated material transported to the Maywood Interim Storage Site (MISS), adjacent to the Stepan Company plant.[3] After removal of all contaminated soil, the property was restored to its original condition. Using a combination of procedures, the contamination was controlled and prevented from spreading to other areas. A post-remedial radiological survey was conducted by BNI to ensure compliance with DOE remedial action guidelines.[4]

The DOE adapted a policy to assign an independent verification contractor to ensure the effectiveness of remedial actions performed within FUSRAP. The Radiological Survey Activities Group of Oak Ridge National Laboratory (ORNL) has been assigned the

*The survey was performed by members of the Radiological Survey Activities Group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-840R21400.

responsibility for this task at the Maywood site. This report describes the methods and results of that verification.

From January to June, 1986, ORNL conducted the verification activity for the Rochelle Park property at 90 Park Way, which adjoins the Ballod property. A diagram of the property showing the approximate property boundaries and grid network established for measurements outside the buildings is shown in Fig. 2. This is the first in a series of properties in the Maywood site, whose verification will be completed in 1986, that were suspected of being radioactively contaminated and have been surveyed by BNI[3] to identify horizontal and vertical boundaries of radionuclide concentrations exceeding remedial action criteria. An area of <400 m^2 with contamination exceeding the guidelines was located in the back yard of the property and excavated.

PROCEDURES

Objectives

The objective of the verification activities was to confirm that available documentation adequately and accurately describes the post-remedial action radiological conditions of the entire property, which is to be certified, and that the remedial action achieved the authorized limits.

Document Reviews

Review of the designation/characterization report[3] prepared by BNI indicates that the contamination is a shallow deposit and most likely created by runoff from the Ballod property; thus, it was appropriate to designate this property for remedial action.

The post-remedial action report[4] indicates that the area was excavated on this property as identified in the designation report. The post-remedial action survey was performed on this property as described for a generic site in Ref. 5. This survey consists of ground level beta-gamma measurements, near-surface gamma measurements, and systematic soil sampling. From the review of the post-remedial action report, it can be concluded that the survey procedure used for this property is satisfactory. All reported ^{238}U, ^{226}Ra, and ^{232}Th soil sample concentrations are below the average guideline limits set by DOE in Table 1.

VERIFICATION SURVEY AND ANALYSIS

Typical background radiation levels for the Rochelle Park, New Jersey, area are presented in Table 2. The data are provided for purposes of comparison with the survey results presented in this section.

All measurements presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point measurements are presented in the confirmatory report by BNI (Ref. 4). Gamma measurements were made approximately 30 cm above each grid point using a Primary Excavation Control Instrument (PECI). Gamma exposure rates at 30 cm above ground surface ranged from 3805 to 8921 counts per minute (cpm). The maximum gamma exposure rate measured was 8921 cpm around the excavated area at the back side of the property at approximately grid location E8953, N9045. It was indicated by BNI that 10,000 cpm corresponds to 5 pCi/g.

Eight pressurized ionization chamber (PIC) readings were taken at this property by BNI. The results and the locations of these readings are presented in Table 3. Gamma exposure rates at 1 m above ground surface ranged from 10 to 12 μR/h (microroentgens* per hour) and averaged 10 μR/h.

Soil Sampling

Before backfilling, a total of twenty-two soil samples was taken by BNI in the excavated area. The procedures used for soil sample analysis have been described in Ref. 3. Results of the soil sample analysis and the locations of the samples are given by BNI in the post-remedial confirmatory report.

Five systematic soil samples were selected for independent verification by ORNL from different locations at varying depths (see Table 4). The five samples have been analyzed for ^{238}U, ^{226}Ra, and ^{232}Th according to the procedure described in Ref. 6.

Concentrations of ^{238}U in the soil samples ranged from 0.8 to 1.4 pCi/g (picocuries† per gram) and averaged 1.2 pCi/g. Concentrations of ^{226}Ra in the soil samples ranged from 0.6 to 1.3 pCi/g and averaged 0.8 pCi/g. Concentrations of ^{232}Th in the soil samples ranged from 1.4 to 3.3 pCi/g and averaged 2 pCi/g. Locations of the soil samples are shown in Fig. 3. Results of both types of analysis for the aforementioned five soil samples are given in Table 4, with results by BNI in parenthesis for comparison of the analyses.

*The roentgen (R) is a unit which was defined for radiation protection purposes for people exposed to penetrating x-rays or gamma radiation. A microroentgen (μR) is one millionth of a roentgen. A milliroentgen (mR) is one thousandth of a roentgen or one thousand microroentgens.

†The curie is a unit used to define the radioactivity in a substance and equals that quantity of any radioactive isotope undergoing 2.2×10^{12} disintegrations per minute. The picocurie is one million-millionth of a curie or that amount yielding 2.2 disintegrations per minute.

CONCLUSION

Measurements of the gamma exposure levels taken from the excavated area before backfilling determined that the exposure rate at 1 m above the ground surface ranged from 10 to 12 μR/h and averaged 10 μR/h. For comparison, the typical background for the northern New Jersey area[7] is 8 μR/h; and the background for the state of New Jersey[8,9] averages 7.9 μR/h and ranges from 6 to 11 μR/h based on 1968 measurements. These values are well below background plus 25 μR/h, as required by DOE guidelines.[10] Additionally, the results of radionuclide analyses of ^{238}U, ^{226}Ra, and ^{232}Th show that all soil concentration measurements are within the limits prescribed by DOE radiological guidelines.[10]

Based upon the results of the post-remedial action data and confirmed by the verification survey data, all external gamma exposure rates and soil concentration measurements fall well below the limits prescribed by DOE radiological guidelines established for this site. It is concluded that the site successfully meets the DOE remedial action objectives.

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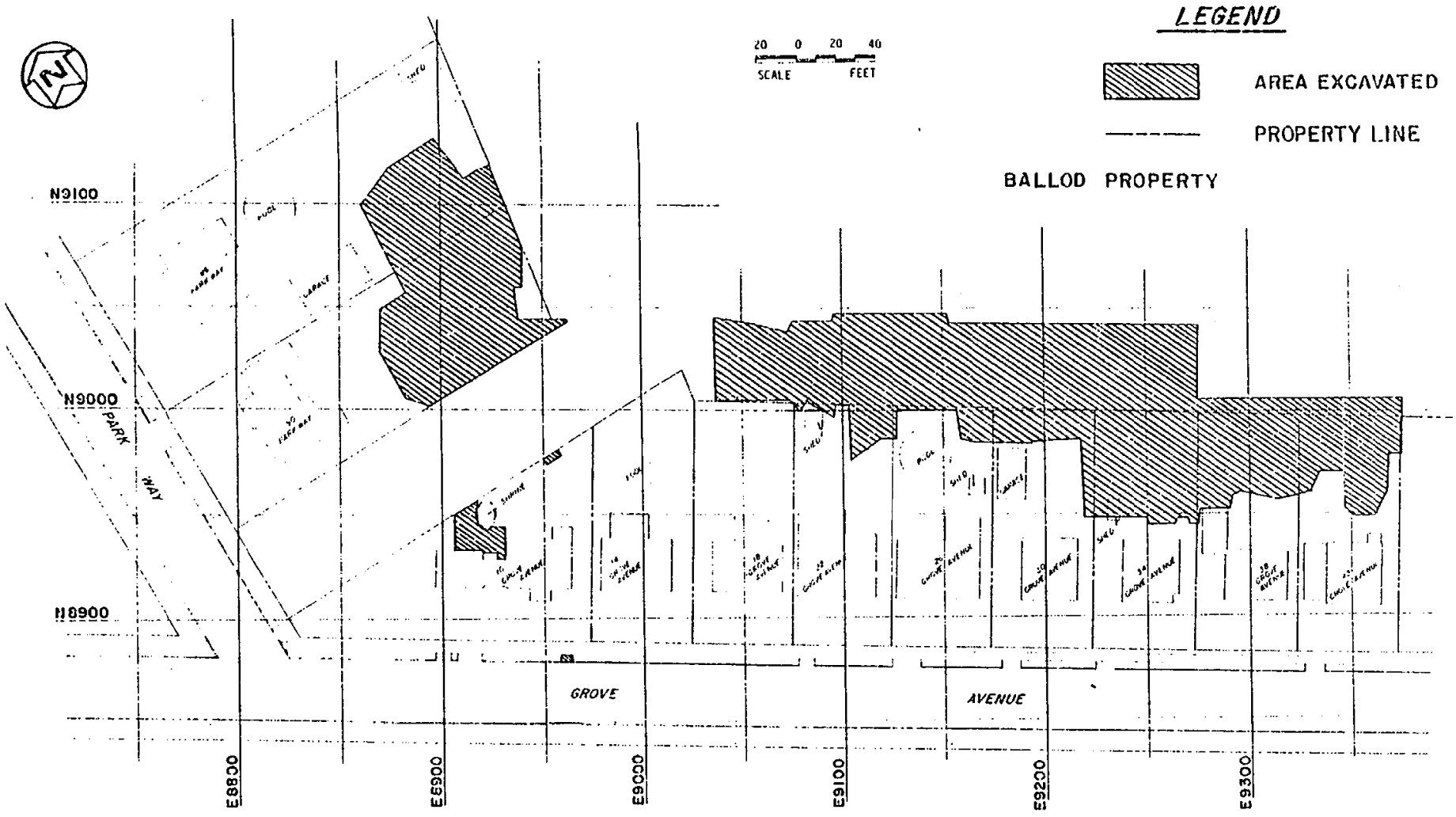

Fig. 1. Vicinity properties in the Rochelle Park, New Jersey, area.

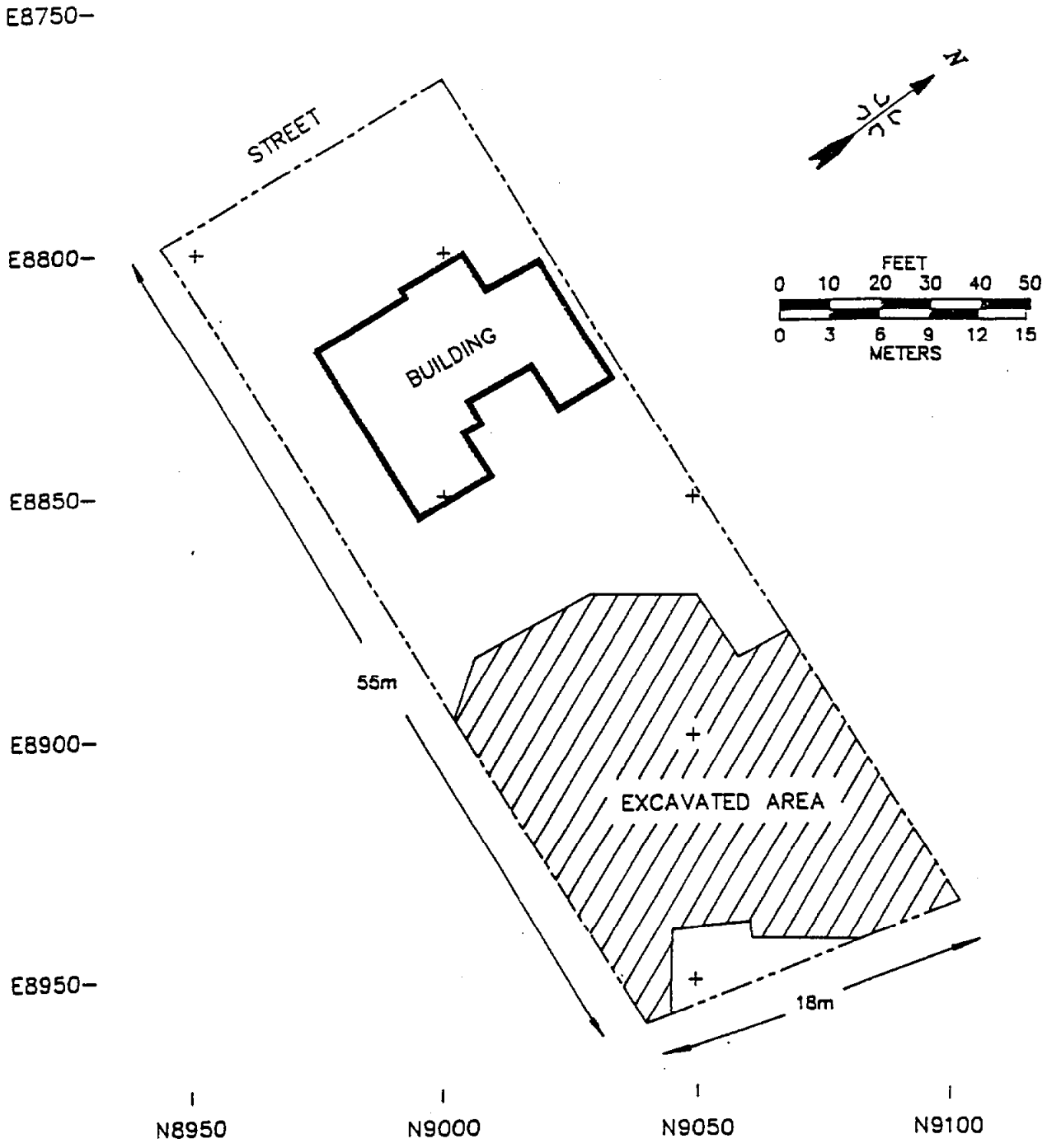

Fig. 2. Diagram showing grid point and grid block locations outdoors on the property at 90 Park Way, Rochelle Park, New Jersey (MJ01L).

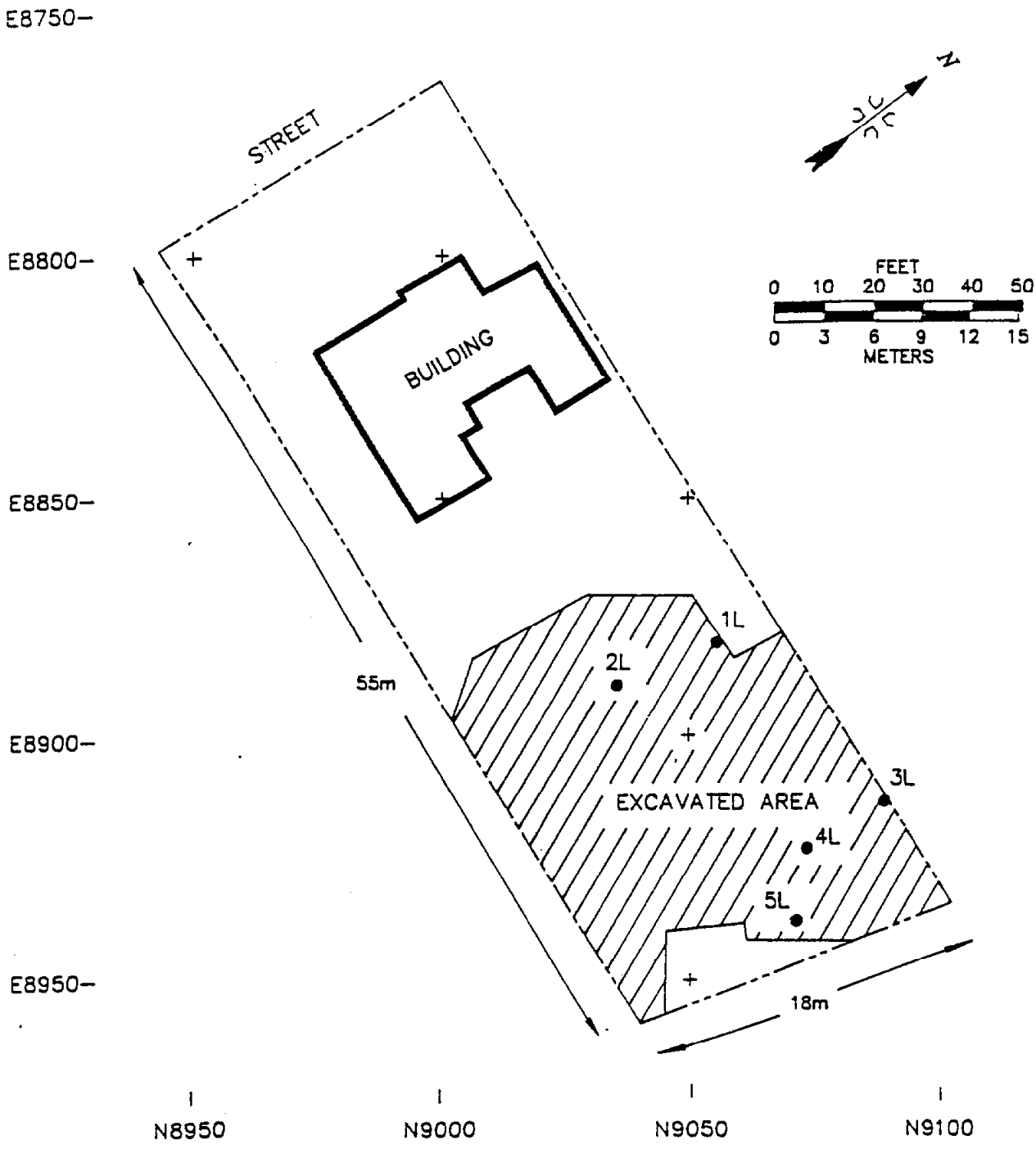

Fig 3. Locations of soil samples on the property at 90 Park Way, Rochelle Park, New Jersey (MJ01L).

Table 1. Summary of residual contamination guidelines for the Rochelle Park site

Soil (Land) Guidelines (Maximum Limits for Unrestricted Use)

Radionuclide	Soil Concentration (pCi/g) above background[a,b,c]
Radium-226 Radium-228 Thorium-230 Thorium-232	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
Other radionuclides	Soil guidelines will be calculated on a site-specific basis using the DOE manual developed for this use

Structure Guidelines (Maximum Limits for Unrestricted Use)

Indoor Radon Decay Products

For Rn-222 and Rn-220 concentrations in buildings, the average annual radon decay product concentration (including background) due to uranium or thorium byproducts should not exceed 0.02 WL after remedial action. When remedial action has been performed and it would be unreasonably difficult and costly to reduce the level below 0.03 WL, the remedial action may be terminated, and the reasons for termination should be documented. Remedial action shall be undertaken for any building which exceeds an annual average radon decay product concentration (including background) of 0.03 WL.

Indoor Gamma Radiation

The indoor gamma radiation after decontamination shall not exceed 20 microroentgen per hour (20 μR/h) above background in any occupied or habitable building.

Indoor/Outdoor Structure Surface Contamination

Radionuclide[e]	Allowable Surface Residual Contamination[d] (dpm/100 cm^2)		
	Average[f,g]	Maximum[f]	Removable[f]
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, AC-227, I-125, I-129	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000	15,000	1,000

Table 1 (continued)

Indoor/Outdoor Structure Surface Contamination

Radionuclide[e]	Allowable Surface Residual Contamination[d] (dpm/100 cm^2)		
	Average[f,g]	Maximum[f]	Removable[f]
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000	15,000	1,000

[a]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.

[b]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.

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

[d]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[e]Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides shall apply independently.

[f]Measurements of average contaminant should not be averaged over more than 1 m^2. For objects of less surface area, the average shall be derived for each such object.

[g]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h at 1 cm and 1.0 mrad/h at 1 cm respectively, measured through not more than 7 mg/cm^2 of total absorber.

Table 2. Background radiation levels in the Rochelle Park, New Jersey, area

Type of radiation measurement or sample	Radiation level or radionuclide concentration	
	Range	Average
Gamma exposure rate at 1 m above floor or ground surface (μR/h)[a]	8–11	9
Concentration of radionuclides in soil (pCi/g)[b]		
^{238}U	0.13–1.4	0.86
^{226}Ra	0.24–1.4	0.87
^{232}Th	0.31–1.5	0.9

[a]Values obtained from 35 locations in the Rochelle Park area.[8]

[b]Soil samples obtained from locations around the Maywood area.[6]

Table 3. The results and the location of the pressurized ionization chamber (PIC) measurements at 90 Park Way, Rochelle Park, New Jersey (MJ01L)*

Coordinates		Gamma exposure rate (μR/h)
East	North	
8880	9050	10
8890	9025	10
8895	9065	10
8910	9050	10
8910	9080	12
8920	9025	10
8925	9065	10
8940	9050	11

*Ref. 4.

Table 4. Results of soil sample analyses on the property at 90 Park Way, Rochelle Park, New Jersey (MJ01L)

Sample	Location[a]		Depth (cm)	Radionuclide concentration (PCi/g)		
	East	North		^{226}Ra[b]	^{232}Th[c]	^{238}U[d]
				Systematic Samples[e]		
1L	8880	9055	15–30	1.3 ± 0.06 (0.6)[f]	3.3 ± 0.8 (1.9)[f]	1.4 (<5)[f]
2L	8890	9040	30–45	0.55 ± 0.05 (0.8)[f]	1.4 ± 0.4 (1.0)[f]	0.8 (<5)[f]
3L	8910	9085	45–60	0.86 ± 0.05 (0.6)[f]	2.3 ± 0.6 (1.0)[f]	1.3 (<1.6)[f]
4L	8920	9070	60–75	0.58 ± 0.04 (1.1)[f]	1.4 ± 0.4 (0.3)[f]	1.3 (<5)[f]
5L	8935	9070	75–90	0.68 ± 0.1 (0.5)[f]	1.6 ± 0.6 (0.9)[f]	0.96 (<1.8)[f]

[a]Locations of soil samples are shown on Fig. 3.
[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).
[c]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).
[d]Analytical error of measurement results is less than ±5% (95% confidence level).
[e]Systematic samples are taken at grid locations irrespective of gamma exposure.
[f]BNI results are shown in parentheses.

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